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ABSTRACT

The proceedings for the 1990 forum provides both summaries of introductory and special remarks and 10 papers together with the full text of the following papers: (1) "The Changing Information Landscape: Opportunities for Better Management" (Jeff Bingaman); (2) "Managing Scientific and Technical Information in the 1990s" (D. Allan Bromley); (3) "Future Trends in Government Information Issues" (Prudence Adler); (4) "The Future of the GPO Depository Library Program: Issues and Strategies" (Charles R. McClure); (5) "Access to Government Information: A Canadian Perspective" (Brian Land); (6) "The Medical Community's Views on Open Access" (Gene A. Kallenberg); (7) "Public Needs for Federal Information" (Elliot L. Shelkrot); (8) "The States' View of Access Issues" (James A. Nelson); (9) "What Industry Expects from Federal Information Providers" (Scott K. Kostenbauder); and (10) "Information Science and Changing Needs" (Deanna Marcum). The proceedings for the 1991 forum presents summaries of introductory and special remarks and 17 papers together with the full text of five of the papers: (1) "NREN and Other Information Networks: The Federal Role" (George E. Brown, Jr.); (2) "Future Directions for Federal Libraries and Information Centers" (Pamela Andre); (3) "Balancing the E and R in NREN: The Educational Imperative" (Richard M. Dougherty); (4) "Supporting the Modern Researcher" (Donald N. Langenberg); and (5) "Future Implications for the Profit and Not-For-Profit Sectors" (Allan H. Weiss). The papers at this forum addressed current initiatives and future prospects, key issues for national information networking, federal libraries and information providers--the core of the network information structure, the larger picture--future implications, and approaches and opportunities. The "Forum Call" and agenda are also provided for each of the forums. (BBM)

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Federal Library and Information Center Committee
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Proceedings of FLICC Forums on Federal Information Policies

Combined Summaries of Proceedings

1990 Forum (7th)

Access Is the Key

March 20, 1990

1991 Forum (8th)

Building Information Superhighways: Supercomputing Networks and Libraries

March 21, 1991

IR054129

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About FLICC

The Federal Library and Information Center Committee (FLICC) was created in 1965 as the Federal Library Committee by the Library of Congress and the Bureau of the Budget (now the Office of Management and Budget), renamed FLICC in 1984 to reflect its growing information center constituency, and granted its first comprehensive Bylaws in 1991 by the Library of Congress to formalize its procedures and establish an updated organizational structure.

In the course of these changes, FLICC has established itself as the federal intergency advisory committee that provides leadership and assistance to the nation's federal libraries and information centers, which number approximately 2,500 institutions stretching from coast to coast, extending to Alaska and Hawaii, and reaching Europe and other parts of the globe.

FLICC's purpose is to achieve better utilization of federal library and information center resources and facilities through professional development, promotion of services, and coordination of available resources. FLICC is also responsible for making recommendations on federal library and information policies, programs, and procedures to federal agencies and to others concerned with libraries and information centers.

Through FEDLINK (Federal Library and Information Network), a cooperative program established in 1978, FLICC also offers any federal agency cost-effective access to information and operations support services from commercial sources.

To accomplish these objectives, FLICC draws on the resources of the federal government libraries and information centers. Under the 1991 FLICC Bylaws that broadened membership, FLICC is composed of 57 federal agency members. The 32 members designated as permanent members include the directors of the three national libraries—the Library of Congress, the National Library of Medicine, and the National Agricultural Library—and representatives of the cabinet-level executive departments and other federal agencies with major library programs. Other FLICC members include 15 rotating representatives directly elected by FEDLINK members, nine rotating members elected by the permanent FLICC members, and the chair of FEDLINK's Advisory Council.

Volunteers from federal libraries and information centers support the wide ranging FLICC programs through FLICC Working Groups which focus on federal information policy issues, education, preservation, library binding, personnel, other issues, and cooperative endeavors.

For further information about FLICC services and programs, write to FLICC, Library of Congress, Washington, DC 20540; telephone FLICC at (202) 707-4800; or fax FLICC at (202) 707-4818. FLICC also maintains the FEDLINK Fiscal Operations Hotline at (202) 707-4900 and the ALIX Bulletin Board at (202) 707-4888.

Mary Berghaus Levering
FLICC Executive Director

The Seventh Annual FLICC Forum on
Federal Information Policies
March 20, 1990

Access Is the Key

The Eighth Annual FLICC Forum on
Federal Information Policies
March 21, 1991

Building Information Superhighways: Supercomputing Networks and Libraries

Summaries of Proceedings
Prepared by Carolyn Mulford

Federal Library and Information Center Committee
Library of Congress, Washington, D.C. 1992

Other FLICC Forums:

The First Annual FLICC Forum on Federal Information Policies:
Emerging Issues on Managing Information Resources, February 15, 1984

The Second Annual FLICC Forum on Federal Information Policies:
Inte International Flow of Scientific and Technical Information, February 27, 1985

The Third Annual FLICC Forum on Federal Information Policies:
Their Implementation and Implications for Information Access, February 12, 1986

The Fourth Annual FLICC Forum on Federal Information Policies:
Views of a Concerned Community, February 25, 1987

The Fifth Annual FLICC Forum on Federal Information Policies:
The Impact on Competitiveness, March 7, 1988

The Sixth Annual FLICC Forum on Federal Information Policies:
The Congressional Initiative, March 22, 1989

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The annual FLICC Forums on Federal Information Policies are arranged under the auspices of the FLICC Education Working Group which was chaired in 1990 and 1991 by Edward Liszewski, US Geological Survey. Each year, one or two volunteers from the FLICC Education Working Group serve with an Ad Hoc FLICC Forum Working Group composed of information experts. This Ad Hoc Working Group selects a topic, identifies speakers, and otherwise prepares the Forum program. FLICC wishes to express its appreciation to Catherine Jones, Library of Congress (LC) Congressional Research Service (CRS), Congressional Reference Division, who coordinated the 1990 Forum on behalf of the FLICC Education Working Group; and to Don Fork, US Department of Education and Adelaide Del Frate, National Aeronautics and Space Administration who coordinated the 1991 FLICC Forum. Additionally, FLICC gratefully acknowledges the contributions of the staff of the LC CRS, especially Jane Bortnick, CRS Science Policy Division, and Harold Relyea, CRS Government Division, for the time, effort, expertise, and insights that they have shared on behalf of the federal library and information center community.

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Written by: Carolyn Mulford
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Summaries of the Proceedings of the 1990 and 1991 FLICC Forums on Federal Information Policies

Preface

Early in the deliberations of the 102nd Congress, Senator Albert Gore, Jr. (D.-Tenn.) reintroduced the High Performance Computing Act of 1991. The measure proposed establishing the National Research and Education Network (NREN), a concept he has described as a "a nationwide network of fiber optic 'data highways' to link supercomputers and digital libraries throughout our nation."[2]

The widespread interest in the most recent NREN proposal reflects the continuing attempt of a broad range of publics to keep abreast of the federal government's evolving information policies and to discern what roles might result for both institutions and individuals. Judged by legislative activity alone, there has been a marked increase since 1977 in proposals dealing with the subject of information policy, broadly considered as "societal and institutional decisions concerning the allocation of resources to acquisition, processing, distribution, and use of information." Between the 95th and 100th Congresses, 317 public laws were enacted in nine broad "Information Age" categories, including Information Technology for Education, Innovation, and Competitiveness. In the sessions of the 101st Congress during 1989-90, this last category, which covers attempts to establish NREN and like initiatives, exploded with no fewer than 18 recommended measures.[3]

In response to the increasing demand for information about information policy, the Federal Library and Information Center Committee (FLICC) in 1984 inaugurated the annual FLICC Forum on Federal Information Policies. Serving as FLICC's annual spotlight on this area of vital concern to federal information managers, the Forum has examined such critical federal information policy topics as the international flow of scientific and technical information; the impact of information policy on American competitiveness; the library and information center community's alarm over cutbacks on the availability of federal data and publications, and the role of Congress in formulating information policies.

As the idea of an NREN gained widespread currency, FLICC moved on behalf of the federal library and information center community to examine, in a variety of presentations and special reports, the broad issue of access in an era of proliferating databases and the specific issue of the federal role in NREN and other information networks. In successive Forums in 1990 and 1991, FLICC highlighted first the administration's initiatives to forestall what its own science advisor, D. Allan Bromley, termed an electronic "Tower of Babel" resulting from widely varying standards, and then the specific attempts to build NREN in the 1990s advocated by Gore's House ally, Congressman George Brown (D.-Ca.), and a wide range of information highway "hard hats" in the government and corporate sectors.

> *We are witnessing the emergence of a new global civilization. We have felt the congealing of the world community for some time now. It has been heralded and prematurely announced many times in the past, but it is abundantly clear that in the 1990s it is here. This global civilization and global marketplace rest upon shared knowledge in the form of digital code, the new 'lingua franca.' Those nations that can best deal with information in that form will be most successful in the economic competition that takes place in the world.*[1]
>
> —*Albert Gore, Jr.*
> *United States Senate*

Concerned individuals and organizations following the subject of information networking have found presentations at FLICC's Forums to be timely. Dr. Bromley who discussed administration initiatives at the 1990 FLICC Forum was described as "the chief proponent of government-industry efforts aimed at helping U.S. firms compete more effectively"[4] and the "highest-ranking administration official advocating both national—and nationalistic—policies to enhance America's technology leadership"[5] at the time the administration proposed increasing budget allotments by 30 percent to $638 million for a four-part, multi-agency plan in fiscal year 1992 to spur research in supercomputing and networking.[6]

The presentation by Allan Weis of Advanced Network and Services at the 1991 FLICC Forum on commercial involvement in the network preceded by several months his announcement in June, 1991 that a for-profit unit, ANS CORE Systems, Inc., had been formed to permit commercial use of Internet, the

precursor to a high speed network, a development characterized as "a key step in the delicate political task that Mr. Weis has undertaken to fashion a consortium of private and public supporters."[7]

Spurred also by legislative debate, professional and public-spirited analysts continued in 1991 to dissect NREN proposals in even greater detail. On the one hand, the Coalition for Networked Information urged professionals to go beyond what it called the parade of public issues appearing on and disappearing from the contemporary scene by asking three core questions: "How should the network be funded and governed? How can we stimulate and manage both technological and public service innovation? How do we assure equitable access?"[8]

On the other hand, activists warned, "... if access to such data networks is restricted to those who already have money, power and information, then these networks might become nothing more than a classic case of economic imperialism, taxation without communication, that one critic has dubbed 'toll roads between information castles'."[9]

There remained too the healthy skepticism that questions whether or not a national information network can achieve its original stated purpose: "Networking advocates assert that continuing development of NREN will provide a means of increasing the effectiveness of the U.S. research community through remote access to powerful resources and new capabilities for collaboration. However, there is little empirical evidence on the nature and extent of a network's ability to enhance the research process and increase research productivity. Many claims about existing and proposed research networks are characterized by enthusiasm and idealism either not documented by empirical studies, or documented with narrow anecdotes about very successful high-profile users who are in unusually privileged positions within the research community."[10] Such skepticism is fueled by recent studies raising fundamental questions in government about the uses of computers, the absence of standards, and the preservation of electronic records.[11]

Because networking initiatives and the ensuing debate about network policies promise to affect the library and information center community well into the foreseeable future, FLICC is presenting the summaries of of the 1990 and 1991 FLICC Forums in this joint publication. The thematic continuity of these reports *Access is the Key*, and *Building Information Superhighways: Supercomputing Networks and Libraries*, is supplemented by FLICC Special Reports and newsletter articles published by FLICC during this period, provide a unique resource.[12]

It is hoped that this background is useful for members of the public seeking basic information on the development of NREN conceptually and operationally and also for professionals tracking NREN as it moved, in the period after the 1991 Forum, from legislative debate to House passage to compromise and approval in the Senate.

1. Quotations are from a taping of Sen. Albert Gore's keynote address, Communications Network '91, Washington, D.C., January 29, 1991.

2. Gore, Al, "Networking the Future," The Washington Post Outlook Section, July 15, 1990, p. B3.

3. Chartrand, Robert Lee. Legislation of the 101st Congress Related to Information Policy and Technology Issues. CRS Report 89-496 SPR. August 1, 1989. Pages 1-2.

4. Richards, Evelyn, "Data Network Funding May Be First Step Toward U.S. 'Technology Policy'," The Washington Post, January 31, 1991, p. E1.

5. Schrage, Michael, "Industrial Policy by Another Name: Allan Bromley's Success as Science Adviser," Los Angeles Times Syndicate column published in The Washington Post, February 15, 1991, p. F3.

6. Booth, William, "President Puts Fiscal Faith in Science," The Washington Post, February 13, 1991, p. 17.

7. Markoff, John, "A Passion for Networking," The New York Times, June 9, 1991.

8. West, Richard, "NREN Issues: Funding, Equity, Innovation," ARL 155: A Bimonthly Newsletter of Research Library Issues and Actions, March 22, 1991, p. 1.

9. Karraker, Roger, "Highways of the Mind," Whole Earth Review, Spring 1991, p. 5.

10. Gould, Stephen. High Performance Computing: An Overview. CRS Issue Brief IB90015. Updated March 12, 1990. p. 13.

11. "Taking A Byte Out Of History: The Archival Preservation Of Federal Computer Records," Twenty-fifth Report by the Committee on Government Operations. House Report 101-978. November 6, 1990.

12. See especially FLICC Special Report 90-7 The High Performance Computing/NREN Initiative: A Focus on Network Services; FLICC Special Report 90-8 Supercomputer Networks and Libraries, and "How Will Scholars Navigate NREN's Speedy Superhighway?" in the August/September 1990 issue of *FEDLINK Technical Notes*.

The 1990 FLICC Forum on
Federal Information Policies (7th)

Access Is the Key

March 20, 1990

Summaries of Proceeding
and Papers

Federal Library and Information Center Committee
Library of Congress, Washington, D.C. 1992

Seventh Annual FLICC Forum on Federal Information Policies
Wednesday, March 21, 1990

Access is the Key

FORUM CALL

Over the last decade, we have witnessed an explosion of information aided by computerized technology. The Age of Information is here. As we stand at the dawn of the twenty-first century, the key to success in the '90s is access to the broad array of information generated, compiled, and stored in various formats—print, film, magnetic and optical media.

In preparation for the Second White House Conference on Library and Information Services (WHCLIS II), which will be held in Washington, DC in July 1991, the focus for this year's forum is Federal Information Policies: Access is the Key. This supports the federal librarians resolution that will be brought to WHCLIS II, "Citizen access to Federal information resources through Federal agency information organizations."

The theme for the White House Conference—information services for literacy, democracy, and productivity—relates to access in very tangible ways. Access is the key to literacy. As literacy advocates point out, libraries are critical to the resolution of the literacy crisis, because they are there in the community and are a natural vehicle for people who are seeking help. Access is the key to democracy. Free and ready access to information is at the core of a democratic society. Recent dramatic events in Eastern Europe remind us of the enormous power of free speech and a free press and of the importance of information access through the media in moving towards democracy. Access is the key to productivity. Our ability to remain competitive in a changing world economy is tied to access.

With the fulfillment of *perestroika* and looking toward a unified European economic community in 1992, will U.S. government information policies shift from a policy of greater controls with emphasis on national security in the '80s to a policy of open exchanges with emphasis on access and dissemination of information worldwide in the '90s? Will depository libraries continue to be points of access and should the legislation establishing depository libraries be rethought in view of rapidly changing information technologies? What is the community perspective on access? In the medical area, how can access help patients make better decisions about their own health care in cooperation with their physicians? Is there a role for government in providing this kind of information? What impact does federal information policy have on states and citizen access? How does access to government-produced information affect what the states are doing, and what role do the states play in the delivery of government information? How does access to scientific and technical information affect our economic competitiveness? What effect do controls on information imposed because of perceived national security concerns have on industry? What do we expect libraries in the twenty-first century to be and how will we prepare the librarians of the future to provide "comprehensive access to knowledge and fast delivery of information?" These and other issues that relate to information access will be discussed at the forum.

This year's forum celebrates the 25th anniversary of FLICC, established in 1965 (as the Federal Library Committee) to serve as a forum and to provide leadership when policy issues arise affecting the provision of information to government employees and the general public. FLICC has arranged these forums, which have become an annual status report on information access and dissemination policy.

FLICC's 25th Anniversary
1965-1990

Federal Library and Information Center Committee

FORUM ON FEDERAL INFORMATION POLICIES: Access is the Key

Wednesday, March 21, 1990
Mumford Room, 6th floor, James Madison Memorial Building
Library of Congress, First Street and Independence Avenue, SE, Washington, D.C.

9:00 a.m.	*Registration*
9:30 a.m.	**Welcome, Introduction, and Program Overview**
	Donald C. Curran, Acting Associate Librarian for Constituent Services Mary Berghaus Levering, Acting Executive Director, FLICC
9:40 a.m.	**Keynote Statement**
	Senator Jeff Bingaman (D-N.Mex.), Chairman, Subcommittee on Government Information and Regulation
10 a.m.	"The Management of Scientific and Technical Information in the Next Decade"— D. Allan Bromley, Science Advisor to the President
10:30 a.m.	*Break*
	FLICC Focus for the Second White House Conference on Library and Information Services: "Citizen Access to Federal Information Resources Through Federal Agencies"
10:45 a.m.	FLAG Update: Federal Librarians' Initiatives—Dorothy Cross, Director, Pentagon Library
	Part I: Government Information Issues
	Presiding: Lee Edwards, Vice Chair, National Commission on Libraries and Information Science
	"Future Trends in Government Information Issues"—Prudence Adler, Federal Relations Officer, Association of Research Libraries
	"The Future of the Depository Library Program: Issues and Options"—Charles McClure, Professor, School of Information Studies, Syracuse University
	"Access to Government Information: The Canadian Perspective" —Brian Land, Executive Director, Ontario Legislative Library, Toronto, and Professor, University of Toronto
	Audience Participation
12:00 p.m.	*Lunch (on your own)*
1:30 p.m.	***Part II: Views of the Community***
	Presiding: David Bender, Executive Director, Special Libraries Association
	"Public Needs for Federal Information"—Elliot L. Shelkrot, Director, Free Library of Philadelphia.
	"The States' Views of Access Issues"—James Nelson, State Librarian, Kentucky
	"The Medical Community's Views on Open Access"—Gene A. Kallenberg, M.D., Assistant Professor of Medicine and Health Care Sciences, George Washington University Medical Center
2:45 p.m.	*Break*
3:00 p.m.	"What Industry Expects from Federal Information Providers"—Scott Kostenbauder, Manager, Information Resources, IBM Corporation
	"Information Science and Changing Needs"—Deanna Marcum, Dean, School of Library and Information Science, Catholic University of America
	Audience Participation
4:15 p.m.	*Adjournment*

Introductory and Special Remarks

Donald C. Curran
Acting Associate Librarian for Constituent Services, Library of Congress

Mary Berghaus Levering
Acting Executive Director, FLICC

Donald C. Curran, acting associate librarian for Constituent Services, Library of Congress, welcomed participants. Curran noted that the Library of Congress, which contains some 90 million items, allows adults with no special credentials to use the public reading rooms 77 hours a week. Most people agree that the collection is publicly available and readily accessible, yet they frequently ask why the library does not have a certain item in which they are interested. The answers to this question include, "We don't have it because no one sent it to us," "We have it, but we can't afford to process, organize, or store it," and, "No one wants it anyway."

Curran introduced the keynote speaker, Senator Jeff Bingaman (D.-N. Mex.), and Mary Berghaus Levering, acting executive director of the Federal Library and Information Center Committee (FLICC).

Mary Berghaus Levering called attention to FLICC's founding in 1965 to provide a forum for federal libraries to discuss policies and other matters of mutual concern and to cooperate whenever possible. She cited its growth under three distinguished directors, Paul Howard, Kurt Cylke, and James Riley, and noted that she assumed her position as acting executive director exactly one year ago.

Levering said, "It has been a momentous year of change for FLICC, and particularly its network component, the Federal Library and Information Network (FEDLINK). It's been a year of real challenge, restructuring, a year of great effort, but we are strongly committed to this organization, and we are strongly committed to the future and to the effective FLICC and FEDLINK programs on behalf of all federal libraries and information centers."

Levering said the annual Forum is an example of FLICC's role in the information community. She praised Catherine Jones, chief of the Library of Congress Congressional Reference Division, Congressional Research Service, for organizing the program of the seventh forum, and Chris Zirps, assistant to the FLICC executive director, for handling the logistics. Levering thanked Harold Relyea and Jane Morton of the Congressional Research Service, Lynne McCay and Lynn Kennedy of the Congressional Reference Division, Joan McKeen of the National Oceanic and Atmospheric Administration, Elizabeth Yeates of the Nuclear Regulatory Commission, and Karen Renninger of Veterans Affairs for their assistance in the cooperative effort.

She then introduced D. Allan Bromley, Science Advisor to the President.

Levering opened the afternoon session with a brief update on federal librarians' planning and preparation for the second White House Conference on Library and Information Services (WHCLIS II).

She reported that in 1987 the federal information community began working toward full participation in WHCLIS II. Federal librarians and information specialists organized a federal task force that has met frequently at the Library of Congress, elected officers, determined a course of action, formed a review committee, identified relevant issues, and made recommendations and then introduced Dorothy Cross.

"There can be no doubt in anyone's mind now about the importance of the White House Conference," said Dorothy Cross, director of the Pentagon Library. "It is obviously ... an event in which every federal librarian has a vested interest. ... Our issues directly relate to the overarching themes of the White House Conference, which are productivity, literacy, and democracy."

She reported that during 18 months the federal librarians' Steering Committee went through "every single resolution and recommendation that had been prepared by the 1979 White House Conference, and we came to the conclusion that our major concerns for federal librarians related to networking, funding, preservation and access. We recommended that all of these issues be addressed under the umbrella, 'Equal opportunity of access to federal information.'" The delegates presented this proposal to the White House Conference on Library and Information Services Taskforce (WHCLIST).

FLICC then formed the Federal Library/ Information Center Advisory Group (FLAG) to "develop a statement and ensure continuing participation of federal librarians" in preparing for WHCLIS II. This group drafted the proposed resolution: "Citizen access to federal information resources through federal agencies." Cross credited Adelaide Del Frate, National Aeronautics and Space Administration, for her major contributions to this work.

Cross said that WHCLIST, which serves as a bridge between the two White House conferences, "passed a resolution that it was not appropriate for them to address issues, policies or resolutions. That really fell under the responsibilities of the delegates to the White House Conference."

The task force recommended that FLAG send copies of its resolution to the WHCLIS II chair, the

task force's chair and secretary, and the associate director of the National Commission on Libraries and Information Science (NCLIS). FLAG sent copies of the resolution along with fact sheets on federal libraries and their resources. According to Cross, many of the regional workshops adopted the idea of access.

Cross said, "The committee also sought with great persistence and lobbying efforts—and I think Mary Levering's legal presentation helped—and was granted $18,000 start-up funds for a Pre-White House Conference for federal librarians and information specialists. They also fought for and won eight delegates to WHCLIS II, four primary delegates and four alternates. This was not easy. These were precedent-setting actions." As a result of FLAG's efforts, the list of WHCLIS II participants will include the federal community.

Asked to nominate an honorary chair for WHCLIS II, FLAG nominated Barbara Bush, whose work with literacy is, Cross said, "internationally recognized."

FLAG is planning the Pre-White House Conference for the federal library community, scheduled to meet in Washington, D.C., in November 1990. FLAG has presented a plan for the federal preconference to NCLIS.

"We need to address the national themes. We need to prepare papers and briefings on networking, preservation, and funding," Cross said. She asked federal librarians to speak out on these issues at professional meetings.

"We need to develop an action list to establish goals and objectives for long-range planning that FLICC can participate in or perhaps carry out, to prepare a series of resolutions, some of which would require legislative action," Cross said. "And then we need to prepare for post-White House Conference actions.

"This is an extremely important activity," Cross continued. "Access is the key to literacy. Libraries are in every community, and they are part of the solution to the problem. Access is the key to productivity. If we do not have accurate, complete, and timely information, there is no way we can compete as a nation, or perhaps even survive. And we all know access to information is the key to democracy."

Cross said she hopes the conference will, at the least, "raise the nation's awareness of the rich resources and the skillful and complex services that the federal libraries have to offer. ... We hope we can impress upon them the absolutely essential need to retain our collections."

Cross appealed to participants to become actively involved, saying, "This is a once-in-a-decade opportunity, perhaps a once-in-a-lifetime opportunity, to be heard, to stand up and be counted." She cited a need for volunteers for various committees, nominations for delegates, and anecdotes to support resolutions. She said every agency should have at least one volunteer and one working member on FLAG.

Keynote: The Changing Information Landscape: Opportunities for Better Management

Senator Jeff Bingaman
Chairman, Senate Subcommittee on
Government Information and Regulation

Senator Jeff Bingaman chair of the recently established Government Information and Regulation Subcommittee, commented that he was pleased to address federal librarians, for he has come to believe that "our policies about information become decisions about how our society itself develops."

He is concerned that technology development is outpacing our ability to benefit from it. He challenged the audience, "Are we asking the right questions, and are we collecting the right data?" He said Congress must ask the right questions to make and implement sound information policy.

Such a policy "strengthens the guidance governing information collection, analysis, and dissemination, as well as the management of electronic information systems." Trade policies, enforcement of the Superfund law, and economic forecasting are examples of matters requiring up-to-date information, but Bingaman pointed out that during the 1980s resources were cut from rather than added to statistical systems.

Bingaman requested a study by the Office of Technology Assessment (OTA) of areas in which better data would improve appropriated economic policy analysis. OTA found "staggering defects" in existing statistical systems. Correcting such defects, he said, "will require a coordinated approach by all branches of government." It also will require more resources, which cannot be appropriated without a mechanism for establishing priorities for the entire U.S. statistical system.

Another critical area, according to Bingaman, is education statistics to guide policymakers at the federal, state, and local levels. Yet the National Center for Education Statistics has undergone budget cuts for years.

The National Center for Health Statistics also is being cut even as it faces such challenges as measuring the health of special population groups, for whom little data exist.

Bingaman called for an in-depth review of the federal information and statistical data system to ensure ongoing improvements. In the Federal Information Resources Act that he introduced to reauthorize the Paperwork Reduction Act, he proposed establishing a Commission on Federal Information. Its functions would include identifying long-term information needs and gaps in the system and setting priorities "to ensure that the system is capable of keeping up with changes in the economy and society."

"Some of these considerations may be worthy of examination at the 1991 Second White House Conference on Libraries and Information Services," he said.

Another major concern, said Bingaman, is information management. Much of the data gathered from space, for example, is not being used because it is not organized for retrieval.

He said, "The information infrastructure necessary to ensure good decision making involves the coordination of a multifaceted federal information policy."

Both the Paperwork Reduction Act and the Federal Information Resources Management Act address information management, according to Bingaman. Hearings on the subject have given him three concerns: the failure of the information collection review process to reduce paperwork and ensure information collection, the absence of an overall government information strategy, and the lack of timeliness and accountability in the regulatory review activity of the Office of Information and Regulatory Affairs (OIRA).

Bingaman accorded great importance to reducing unnecessary government paperwork, and his bill reauthorizes federal information collection provisions, creates a framework of agency responsibilities, and requires OIRA to identify and evaluate initiatives designed to reduce paperwork burdens.

While noting that unnecessary information collection must be eliminated, he called for a better coordinated set of policies, based on principles of information resource management, to help provide useful information.

Bingaman also expressed concern that laws enable the public to have access to government information. He cited several "alarming" limitations, including the Office of Management and Budget's "wholesale elimination" of federal publications and the reclassification of information already released to the public.

Although the Paperwork Reduction Act does not deal with public access to information, Bingaman "saw the need to create a statutory framework" for access in the reauthorization bill. The legislation promotes access in several ways, while recognizing the need for secrecy in such security matters as weapons technology and such personal information as tax returns.

Bingaman called for changing the mindset that reduces, eliminates, or hides information and providing the leadership necessary to allow the public to benefit from the advantages of the Information Age.

Managing Scientific and Technical Information in the 1990s

D. Allan Bromley
Assistant to the President for Science and Technology and Director, Office of Science and Technology Policy

D. Allan Bromley began by calling forum participants, "the world's shock troops in addressing the tidal wave of information inevitably bearing down on us."

In these early years of the Information Age, he said, the free flow of information remains central to our democratic ideals. It also plays a vital role in maintaining economic competitiveness.

Today we tend to measure information in bytes rather than books. Memory capacity has been increasing 35 percent per year for the past two decades. If it continues at that rate, in a few decades each person in a world population of 15 billion could have the equivalent of the contents of the Library of Congress.

Technologies have bound the world into a global village, and information has become one of the most important media of exchange, Bromley said.

Bromley focused on scientific and technical information (STI), which includes three broad types of information (bibliographic, numeric, and graphic) with distinct sources, separate formats, and often separate processing systems. The trend for all three is toward electronic or optical storage systems.

Distinguishing characteristics of STI also include its specialized audience and its huge and mushrooming volume. Databases in the earth sciences alone hold more than 10 times as much data as the Library of Congress, and that is a trickle compared to the flood coming in the 1990s. The federal government is the world's major generator of

STI.

Present budgets and technology do not allow for the collection, storage, and analysis of the coming flood, let alone making it available to users. Bromley called attention to several issues: access and dissemination of information in the private and public sectors, digital literacy and user-friendly software, standardization of databases for international use, and collection and dissemination of foreign STI needed to enhance economic competitiveness.

Bromley said that if STI is to be used to maximum advantage, the federal government's means and institutional structure for handling it must be improved. The Office of Science and Technology Policy (OSTP) is working on this.

One of OSTP's responsibilities is coordinating federal research and development (R&D) that cuts across agency lines. OSTP does this partly through the Federal Coordinating Council for Science, Engineering, and Technology (FCCSET).

FCCSET committees have shown the advantages stemming from effective coordination. For example, the Committee on Earth Sciences has organized disparate research into the U.S. Global Change Research Program, thereby cutting down on duplicative research, increasing the effectiveness of research, and giving R&D increased visibility.

FCCSET is being reorganized to play an enhanced role within the White House. It is establishing umbrella committees in such areas as life sciences and physical sciences and subcommittees in such areas as high performance computing. The latter will be the focus of the new President's Council of Advisors on Science and Technology (PCAST). As chairman of both, Bromley will coordinate their activities.

High performance computing is one of four main areas in which OSTP is involved. The others are education, economic competitiveness, and global change. All involve STI.

Last fall Bromley sent to Congress a report entitled *The Federal High Performance Computing Program*. It presented a four-part program: developing hardware making possible computers that performs at trillions of operations a second; developing software for such hardware; building a National Research and Education Network (NREN) that will increase accessibility to STI and reduce incompatibility among agency systems; and training personnel.

He said he is meeting with agency heads and their deputy directors for R&D to explore expanding the federal high performance computing program into a national program.

The emerging Information Age and explosive growth of technologies are forcing rapid change in STI. For example, the National Technical Information Service's sales of print and microfiche documents have declined 50 percent since 1980 while sales of its computer products and online searching have grown exponentially. American scientists are postponing investigations because they cannot get time on supercomputers.

On the other hand, demand for STI comes from the many scientists who are ready to use supercomputers, and the United States still leads in the design and development of supercomputers, workstations, and parallel processing computers. Such programs as the High Performance Computing Program can keep American R&D efforts at the frontiers of science.

Scientists are not the only ones who can profit from information technology, Bromley stressed. Students and teachers, publishers customizing their periodicals, and individuals using the local library can gain from what is already technically feasible.

Management of STI must keep pace with rapid changes. That requires exploring emerging technologies, reexamining institutional structure, increasing flexibility in responding to needs and opportunities, supporting planning and maintenance of critical data repositories, and improving access.

Bromley concluded, "A new phase of the industrial revolution is now under way, a phase that depends not so much on machines as on information. ... You are the people playing the key roles in deciding whether we can use the flood of information that is coming at us effectively, easily, and in a friendly fashion, or whether we are going to be swamped by it."

Part I: Government Information Issues

Introductory Remarks—
Lee Edwards
Vice Chair, National Commission on Libraries and Information Science

Lee Edwards , vice chair, National Commission on Libraries and Information Science (NCLIS), presided over the morning panel on *Government Information Issues*. He introduced the panel members and the issue of citizen access to federal information resources.

Edwards said that NCLIS recently drafted principles of public information policy. These covered five points: citizens' right of ready access to information regardless of format, the integrity and

preservation of information regardless of format, privacy rights, the diversity of sources, and costs that do not obstruct access.

Future Trends in Government Information Issues

Prudence Adler
Federal Relations Officer
Association of Research Libraries

Fast-paced technological change is one of the driving forces behind the information policy debate, Adler said. She reviewed the role of depository libraries in providing access to government information. Libraries long have been primary channels by which the public can obtain information on government activities. Congress recognized the need for those channels in the 1800s and designated selected libraries to serve that function.

Today the depository library program has more than 1,400 participating libraries around the country. The federal government provides information to the libraries, which provide no-fee access to approximately 167,000 users per week.

New technologies for collecting, managing, and disseminating information do not change the need to access it, Adler stressed.

She reiterated principles on government information in electronic format adopted by the Association of Research Libraries (ARL) in 1987. ARL advocates: the open exchange of public information; federal policy in support of the integrity and preservation of government electronic databases; no copyright on U.S. government information; diversity of sources, including those that are private, of access to U.S. government information; availability of information at low cost; and a system to provide equitable, no-fee access to basic public information.

Many in the library community are focusing on the problem of costs related to access via new technologies. This springs, in part, from an awareness that information in electronic format has a greater economic value than that on paper or microfiche.

Economics, not civil liberties, is likely to dominate in the 1990s, Adler said. Several factors contribute to this, including: the unusually quick introduction of new services, new formats, and new costs; hope that technologies will help government make information accessible efficiently while meeting increasingly sophisticated user needs; and the question of whether technologies will bring enough new savings to offset additional costs that could reduce access.

These factors have led to congressional updating of statutes governing the new electronic environment, put new pressures on depository libraries to make information available regardless of format and costs, and prompted questions on the federal information system's current structure. Recent congressional activity includes reauthorizing the Paperwork Reduction Act, updating the Government Improvement Act of 1990, examining the National Technical Information Service, and initiating the National High Performance Computing Technology Act (that would establish NREN).

This legislative activity affects depository libraries in several ways: electronic products and services are becoming significant segments of collections; their use is involving additional costs; and libraries are turning to networks and bulletin boards to meet user needs.

Adler pointed out that many libraries are accessing data resources at other libraries via Internet. With printed knowledge doubling every eight years and single-site storage impossible, telecommunications and computing technologies permit libraries to go beyond their own walls to serve scholars, researchers, and the public.

She highlighted ways libraries are combining government information with other sources.

- The Penn State College of Agriculture developed a database called PenPages to disseminate reports and bulletins electronically for the Agricultural Extension Program. In one year more than 335,000 users—farmers, businesses, schools, researchers—transmitted 57,000 messages.
- The Department of Commerce Economic Bulletin Board, available for an annual fee of $25 plus online charges, gives the latest economic data. Libraries download all or parts of the file and manipulate the data with other online resources.
- In an online publishing program of the Genome Project at Johns Hopkins University's Welch Library, geneticists, students, and others may respond to the author via electronic mail. The result is a constantly updated computerized textbook.
- The National Agricultural Library has sponsored a project with the North Carolina University Libraries to design an Internet-based document delivery system. Libraries, researchers' workstations, and agricultural extension offices receive scanned images of documents for printing or saving on diskette. This project will become international in the mid-1990s.

Adler said these programs demonstrate the potential for expanding access to government

information and demonstrate its economic value to local and state economies.

Introducing such services, however, places new pressures on libraries to buy hardware and software, to train staff, and to maintain collections in a variety of formats. Libraries are meeting the challenges by using computer networks and developing new programs.

The financial implications remain unclear, but clearly computer networks enable libraries to move large amounts of data inexpensively and to help users identify and access information resources.

Adler said, "Our growing dependence upon networks and information technologies could require new models for the delivery of information to users." That means rethinking the way government delivers information to the public via depository libraries in order to take advantage of the new networked system and to reduce potential costs of access.

"The traditional relationship between the depository libraries and the federal government should not change with the introduction of these new technologies," Adler said. These technologies present new opportunities for the libraries, the government, and the users.

"Electronic distribution of information has the potential for significantly increasing the points of access," Adler said, "but only if we consciously design a system to that end."

The Future of the GPO Depository Library Program: Issues and Strategies

Dr. Charles R. McClure
Professor, School of Information Studies
Syracuse University

Charles McClure began by pointing out that the Government Printing Office (GPO) Depository Library Program (DLP) is one of the most important ways of providing public access to government information. He called for public debate on restructuring and strengthening the DLP to make it an effective dissemination mechanism in the twenty-first century.

McClure cited several key trends and issues: increased demand from users for more and better information services than are now available; escalating start-up costs for information technologies; pressures on the federal and library budgets; improvement of information technology management and user skills; increased remote access; proliferation of federal information dissemination mechanisms in electronic format; and private sector pressures for a larger role in federal information dissemination.

The new technologies and a national high-speed electronic research network converge to provide unique opportunities for improving access to government information.

Institutional support for individual depositories, however, has been stagnant recently. A survey suggests they have too many responsibilities and too few resources. Agencies set up their own dissemination programs and circumvent GPO, which has undergone cuts. The DLP has fallen behind.

Considering the future roles of the DLP, McClure looked at three aspects of its development and the changing dissemination context. First, DLP has always been one of many mechanisms that provide public access to government information, and specialized users, not the general public, dominate. Second, dissemination systems have been designed to meet internal agency needs, not those of the users. An assessment of user needs and how to meet them is needed. Third, DLP traditionally has served as the basic government safety net to guaranteed public access to government information, but numerous statutes now give agencies responsibility for disseminating information. Now, the DLP is one of many safety nets, but it is unclear which target audience each net will catch.

There have been many proposals for restructuring the DLP to support adequately the dissemination needs of government agencies and encourage increased public access. Nine alternative approaches are: centralized agency, information resource center, area regional depository, voucher, commercial, sales depository, approval plan, state data center, and comprehensive.

An approach suggested recently is based on the county extension agent model, with federal agencies supporting individuals knowledgeable about information resources and services and trained to be intermediaries between the public and the depository library. The Association of Research Libraries has proposed that some depositories provide basic services, others intermediate services, and still others full services.

Recently the Office of Technology Assessment proposed three alternatives: the status quo, the electronic depository library, and the reorganized electronic depository system. The private sector advocates letting depository libraries buy what they choose from "any appropriate source."

McClure said all proposals require careful review and public debate. The possibilities include shifting the DLP from a central dissemination mechanism to a referral system to the appropriate dissemination

agency or activity.

Congress has paid little attention to restructuring the DLP, according to McClure. The 1991 White House Conference may help bring together various stakeholders who may paint a vision of the DLP in the twenty-first century, but the concerned organizations need not wait for that to begin drawing congressional attention to the issues.

McClure concluded, "We cannot allow the DLP to enter the twenty-first century in 1895 dress. We must all work together to debate, define, propose, and implement a new vision of a federal depository program that better meets the diverse information needs of the public."

Access to Government Information: A Canadian Perspective

Brian Land
Executive Director,
Ontario Legislative Library
Professor, University of Toronto

Brian Land addressed the topic of citizen access to federal government information resources in Canada with reference to the three themes—literacy, democracy, and productivity—of the 1991 Second White House Conference on Library and Information Services.

In 1987 a survey found that 24 percent of Canadian adults were functionally illiterate. Furthermore, the average Canadian could not easily read or understand the average Canadian government publication. As a result, the federal government established a National Literacy Secretariat to be responsible for research and policy development and serve as a liaison with provinces and volunteer groups.

The National Library of Canada plans to develop guidelines for assessing the readability of government publications measured against the needs and literacy levels of the intended audience.

Turning to the theme of democracy, Land said that in 1983 the Access to Information Act gave Canadians the right to access—with certain exemptions—records held by the federal government. A parliamentary committee reviewed the provisions and operations of the act after three years and reported it had "major shortcomings and weaknesses."

One problem was that few government workers or citizens were aware of the act. The committee recommended education for both the public and government employees.

The committee made 107 other recommendations, including some dealing with the numerous exemptions, delays in processing requests, and excessive fees. The Government of Canada rejected outright almost all recommendations, Land reported. It stated that action should focus on administrative measures, such as training for government employees. The officer of Parliament responsible for administering the act called the government's response "inadequate" and "inappropriate." One observer wrote that the government "has a hard time living with access to information."

On the positive side, some government publications will be made available to the public online.

Only approximately 10,000 of some 300 million requests for information fall under the Access to Information Act each year. One senior official has estimated that "only 50 percent of current information holdings in the government are sufficiently documented to satisfy all policy and statutory requirements."

The government is seeking to remedy this. In July 1988 the Treasury Board (the equivalent of the U.S. Office of Management and Budget) issued the *Government Communications Policy*. This addresses, among other things, the availability and dissemination of information.

The *Policy* recognizes that the Access to Information Act does not replace or limit existing access procedures. It then cautions government employees that providing information is costly and should be done only where the duty to do so is clear or the user is willing to pay for it.

In August 1989 the Treasury Board issued the *Management of Government Information Holdings*. It requires government departments to manage all information holdings as a corporate resource and to maintain a centrally coordinated inventory. The government is to encourage wide internal use of information by ensuring it is fully indexed and accessible.

This policy forms the first part of a three-part manual on management, with the other parts to be published later. The Canadian government has opted for a series of documents on information policy rather than an omnibus document.

Policies established by the Treasury Board govern the Depository Services Program (DSP), which is administered by the Canadian Government Publishing Centre.

The DSP ensures the public access to federal publications through 52 full depository libraries (one of which is the Library of Congress) and nearly 900 selective depositories (public and university libraries).

A Library Advisory Committee has served as liaison between the Canadian Government Publishing Centre and depository libraries since 1979. Recently a Task Force on Depository Program Review conducted a comprehensive survey of participating libraries to determine whether the DSP is meeting its objectives. Although results had not been announced, Land said the Canadian Government Publishing Centre is considering major modifications.

The future of the DSP is closely linked to the issue of access to government information in electronic format, according to Land. The present depository program applies only to print and microforms, but more and more information is available in electronic format. Depository libraries have asked that the DSP include electronic products. Government policy has been that, in the absence of a statutory responsibility to inform the public, users, not taxpayers, should pay for the information.

Finally, three conferences involving the United States, the United Kingdom, and Canada have sought to define the role of information in the changing world economy. In the preamble to the Glenerin Declaration in 1987, the group noted that we have moved from an Industrial Age to an Information Age in which information is an economic resource.

The Glenerin Report said that one particular responsibility of government is to make a minimum level of information accessible to all citizens regardless of means.

Question-and-Answer

A participant asked Charles McClure to comment on difficulties in gaining access to copies of federal rules and regulations in the U.S. District Court of the District of Columbia. The questioner said the U.S. District Court of the District of Columbia is open only to judges, the District of Columbia Court of Appeals is open only to members of the bar who pay a $50 annual fee, and the George Washington University Law Library is open only to alumni who pay a fee.

McClure agreed that fees at the courts is a critical access problem. As a depository library, the university violated the questioner's right to access. McClure said, "Unfortunately, most people who encounter that situation do not hold up Title 44 of the *U.S. Code* to shield themselves."

Another participant asked McClure and Adler what federal librarians could do to take advantage of the current legislative activity to improve the future of the depository program.

McClure replied, in part: "I don't think we, the information community, are ready to make recommendations to Congress about what we might do to move forward the depository program." He recommended open debate and airing of issues as ways to develop meaningful proposals and a unified approach.

Adler commented that "the depository program must be recognized statutorily."

Moderator Lee Edwards added: "One of our principles is that there should be a federal depository library program adequately funded and adequately accessible, and including all formats. We can see ... how critical the depository library program is."

Part II: Views of the Community

Introductory Remarks—
David Bender
Executive Director, Special Libraries Association

David Bender, executive director of the Special Libraries Association (SLA), served as moderator of the afternoon panel on *Views of the Community*. Before the panel began, he commented that approximately 10 percent of the Special Libraries Association's (SLA) members come from the federal sector.

Bender also shared some thoughts on changes coming in the next decade and the twenty-first century. In a rapidly changing society, he said, the information profession realizes that information is the nation's greatest resource. "We must ask ourselves, however: Are we doing all that we can do to help utilize that resource to the fullest extent?" he asked.

He said that librarians have always known information has value, but now we live in an Information Age, which is also an age of competitiveness. "It doesn't matter whether or not you are in the midst of a leveraged buyout, competing for a government contract, or simply needing other information carried either by the federal government or some other agency," he said. "How are you going to deliver that in a timely, cost-effective manner?"

Obtaining information has become increasingly difficult because of delays and obstacles, according to Bender. He said, "We, as a profession, must continue to study, examine, and use all kinds of public documents and government information, and ensure these are readily and and easily available."

He continued, "We know that we also are being affected by budget constraints, issues of national security, and exploding technological advances, which will change our ways of delivering service to our users throughout the next decade."

SLA was sponsoring a meeting on national information policies April 30 to discuss such problems. Many SLA members are involved in examining access and other issues in preparation for the Second White House Conference on Library and Information Services.

Bender introduced the panel, saying that the panelists would provide the perspective on public access to federal information and other issues from the point of view of the medical community, the states, industry, and information science education.

The Medical Community's Views on Open Access

Gene A. Kallenberg, M.D
Assistant Professor, Medicine and Health Care Sciences, George Washington University Medical Center.

Members of the medical community rarely become involved in issues, such as national security, that restrict their access to federal information, Gene Kallenberg said. The issues of required testing for AIDS and confidentiality of the findings are notable exceptions, but ones outside his expertise, he noted.

Kallenberg, a primary care physician, chose to discuss access to information from the perspectives of the patient and the physician. Kallenberg said his best results come when he and an educated patient work together as equal partners. The patient carries out the therapeutic plan well because he or she understands the reasoning behind it.

The educated patient, Kallenberg said, is one with access to three kinds of information: how the human body works, how environment affects it, and how to promote health and prevent disease.

The socioeconomically disadvantaged have less access to information and education than others do. Kallenberg said, "I believe that in our society, with all its technological and medical advances, this is one of the great remaining injustices today."

Health education is a life-long process that gets inadequate emphasis at home and in the schools. Parents, teachers, friends, television, and the government all play vital roles in the evolution of individual health habits, Kallenberg said. Knowledge of the effects of the environment and of methods of preventing disease frequently comes from the government through its regulatory powers and funding of basic research.

Librarians are among those who can help make health information more readily available in convenient forms, and physicians "are recognizing the benefits of specific and focused patient education efforts."

Kallenberg advocated increasing education efforts in elementary and high schools, primarily through teaching human biology and prevention and early detection of our most prevalent and costly maladies, cardiovascular disease and cancer.

He also emphasized the need for better organization of clear and concise patient education materials that public libraries could help disseminate to all citizens, including the socioeconomically disadvantaged. In the future, online networks may provide such information.

From a practicing physician's perspective, the problem is not getting information, rather organizing the torrent in order to lay hands on the appropriate information. Kallenberg estimated that he looks up information for one-fourth to one-third of his patients after their initial visit. He once used only medical texts and journals stacked in his office, but such online sources as MEDLINE and the university's Mini-MEDLINE make searching faster and more efficient. It can perhaps be done while the patient is still in the office.

CD-ROMs make it possible to search large databases locally on a personal computer, which keeps down costs. The CD-ROM's capacity for images and sounds can make these valuable electronic textbooks and resources.

Kallenberg said, "Because of the storage capacity alone, it has been estimated that the entire working library recommended for a practicing primary care internist' s needs could fit onto a single CD-ROM. This sounds great until one contemplates how one must organize things so as to be able to access the right piece of this large database at the right time." The answer: very complex indexing.

That will require natural language processing, artificial intelligence, and a unified medical language. A specialized research group at the National Library of Medicine is working on the last of these three items. Kallenberg said such knowledge processing is where medical information management is headed. "It represents an understanding of the relationships between the information and the scientific theory that underpins or predicts how the information will turn out," he said.

Kallenberg predicted that the next generation of doctors will have a "seamless online resource web"

available in their examination rooms. "This web will be composed of solidified medical information (electronic medical texts and journals), collected clinical experience organized by patient (the individual patient record) and by groups of patients or populations of interest (national disease data banks), and ongoing research focused on the interface," he said.

Kallenberg foresees "great positive benefits" to patients and physicians as access to the collective knowledge base of medicine improves. He said that information scientists, librarians, knowledge engineers, and computer scientists will work with medical experts in the access evolution.

Question-and-Answer

A participant asked Kallenberg whether the information for patients should be different from that for doctors.

Kallenberg replied that doctors and patients require two different levels of information, both of which should be available through advanced technology. He would like to see medical information available for patients through such online services as CompuServe and Prodigy.

Another participant pointed out that the National Cancer Institute has a database, PDQ, that has one component for physicians and another for patients. Information Access Company of California has developed an online database specifically for patients. Part of the data come from journal articles abstracted for lay people.

Public Needs for Federal Information

Elliot L. Shelkrot
Director, Free Library of Philadelphia

Elliot L. Shelkrot began by naming ten top federal government publications that died in the 1980s and are "sorely missed" by patrons of the Free Library of Philadelphia. Among these were *Top Bulletin: Timely Information on Export Opportunities, National Register of Historic Places, Merchant Vessels of the United States, Housing Finance Review,* and *American Education.*

With 55 libraries throughout the city, the Free Library of Philadelphia has 790,000 cardholders and an increasing circulation. As a selective government depository library, it has 11 people in its government publications department. Operating the government depository library costs the Free Library of Philadelphia one-half million dollars per year.

Shelkrot outlined the approach to information in *Information Anxiety* by architect Richard S. Wurman. One of Wurman's themes is that we have lost the sense that *inform* is the key word in information, and that the purpose of providing information is to take someone from one level of knowledge to another.

Shelkrot said that Wurman also advocates, and practices, what Wurman calls *access publishing*. Graphics and content work together to make the publication accessible at whatever level of depth and detail the reader chooses.

In serving its diverse patrons, the Free Library of Philadelphia tries to help people move from one level of knowledge to the next and to give them access to the depth and detail they wish.

To accomplish these ends, recently staff members have changed the way they interact with patrons. They now are using successfully an approach developed in the private sector and tested in libraries in Maryland. It consists of four parts.

- An opening—"How can I help you?"
- A probe—"What exactly can I get for you?"
- A verification—the staff member repeats in his or her own words what the patron has asked.
- A conclusion—"Have I completely answered your question?"

This new interaction has worked very well, allowing staff to operate in a more open and personalized way than unstructured interactions and putting patrons at ease as they seek to ask questions accurately. Shelkrot speculated that one key to the success may be that the approach helps people explain exactly what they are looking for.

Once this is known, the question is how to find it. Shelkrot said that the central library staff members love online systems they can search themselves.

Shelkrot concluded with a list of the top items people used in the government publications department. These included federal regulations, census data, congressional hearings, weather data, and crime reports. The Free Library of Philadelphia's patrons rely on good, timely and accurate government information, he said.

The States' View of Access Issues

James A. Nelson
State Librarian, Kentucky

James A. Nelson posed for consideration a question T. S. Eliot raised, "Where is the wisdom we have lost in knowledge/Where is the knowledge we have lost in information?"

States' perspective on federal information access differs little from others; governments are accountable to the people and people should have access to any information not justly protected. Nelson expressed concern that new technologies may close rather than open channels of access.

State libraries are concerned about accessing federal government information to address the needs of state government and local customers. This involves integrating federal resources into rapidly developing state networks that will make possible one-stop information shopping at the local library.

Nelson pointed out states are becoming key players in the information business, partly because of federal cutbacks and partly because state and local government entities have more relevant connections than the federal and state governments do.

Two issues affecting states' ability to integrate federal information resources into state menus are federal agencies' budgeting for dissemination alternatives and a meaningful federal/state collaboration in data gathering.

Nelson said government may never decide to appropriate funds for information infrastructures and services as it does for other services. The trend is toward charging fees for those using government records in electronic formats.

State and local costs for federal information are sometimes a sore point because state and local agencies often do much of the data gathering, yet the information may not come back in usable form. Nelson called for a more meaningful collaboration that would include:

- considering information gathering problems in order to improve federal information dissemination;
- reducing states' information labor;
- evolving compatibility and standards that meet user needs;
- setting federal information policy that accommodates the diversity of state and local governments;
- giving state and local governments special considerations commensurate with their roles in federal information dissemination;
- making small changes based on specific needs rather than major federal modifications;
- making federal information easier to find and access, more carefully documented, more timely, and more suitably packaged.

Nelson emphasized the importance of linking access to data gathering. He called for more input from the information services community in the design stages in order to meet the needs of end-users and not just the needs of system operators.

Although the new technologies have brought new information awareness, often the technologies rather than the users' needs determine how information is handled in the Information Age.

What Industry Expects From Federal Information Providers

Scott Kostenbauder
Manager, Information Resources,
IBM Corporation

Scott Kostenbauder, manager, Information Resources, IBM, declared that understanding and solving information flow problems is complex. Achieving success in the use of information in industry, for example, is often stated as the goal of having the right information at the right place at the right time. But directing the question within industry to specific professionals yields a wide range of goals representing a wide variety of issues. If a library is to achieve success, preparing and considering traditional activities that might result in an evolving library plan likewise is not the only path to tomorrow.

An alternative philosophically is a performance support system (PSS), an integrated and fully electronic package providing a user access as needed to the tools of the trade and a wide variety of information services. Strategy and economics are the key factors in the design of such information technology. Information suppliers must be prepared to meet the variety of information formats needed.

The desire of industry users to have accurate and timely access must be addressed. Because of the wide variety of agencies in government, important requirements for users are common cataloguing and ordering processes. It is standardization and a single point of contact that gives total access. What is needed for the structuring of government information is a master plan. In the long run, electronic approaches will increase access to federal information by moving the library to the patron via electronics.

Information Science and Changing Needs

Deanna Marcum
Dean, School of Library and Information
Science, Catholic University of America

Deanna Marcum pointed

out that recognition of the need for specialized training for librarians and the failure to take adequate steps to provide it have a long history.

As the profession has changed dramatically, schools have added courses without changing the basic nature of their programs. This, however, is a prerequisite if library and information science education is to flourish.

A key change in libraries has been the way individuals seek information. In the nineteenth century individuals gathered information by reading from collections of materials. Today, library systems remain based on the notion of access, but individuals gather information from many different media. Marcum said that in the twenty-first century "access goals require collections that are access-driven, with demand priorities. The organization of information must be based on the individual query and necessarily link to document retrieval." Students need to know the historical developments of library and information services so that they understand this shift and its service applications.

Many schools try to solve the problem by teaching students about technology, but technology changes constantly. "The real issue for the library school is what does the technology allow the librarian or information professional to do better because it exists?" asked Marcum. She challenged schools to teach students to evaluate technological products for their potential to provide new means of access to information.

To make these judgments, Marcum said, a librarian needs an advanced degree in a subject specialty as well as in library science. Graduates also need to be skilled managers. They must be able to evaluate methods and processes used to make information accessible, make information services cost effective, understand concepts of organizational design and development, and do strategic planning and policy analysis.

They also must be flexible and adaptable people who can apply what they know to new situations.

Those in the profession must help identify and recruit people with the necessary interests, interpersonal skills, and analytical abilities. They often are found in clerical or paraprofessional jobs in libraries.

Considering the demands to be faced, the recruits need to be, or become, forceful speakers, skilled negotiators, and expert lobbyists. Library schools may need to design courses in group process skills to meet these needs.

Part of the professional preparation is in practicum and internships. Practicing professionals are important in helping professionalize students and in providing continuing education to new graduates.

Enrollment in library schools has been declining, Marcum said. The schools and the profession need to take recruiting more seriously if the problems of access are to be solved.

Question-and-Answer

A few participants voiced strong and conflicting opinions on the value of management training for librarians.

One person asked how one can recruit talented people to the profession when salaries are too low to provide an incentive. Marcum said that it is essential to point out the value of the work. She added that having two degrees will improve earnings. ■

The Changing Information Landscape Opportunities for Better Management

Senator Jeff Bingaman (D-N. Mex.)
Chairman, Senate Subcommittee on
Government Information and Regulation

As chairman of the Senate Subcommittee on Government Information and Regulation, I have quickly come to appreciate the crucial role played by information resource professionals in the decision-making process at all levels of government.

As I have become more familiar with the issues of information policy during the past year, I have been frequently impressed by the fact that so many information issues are the very issues we are really confronting in order to address problems involving education, environment, science and technology, and so much more. America is in the midst of an Information Age when policies about information become decisions about the very nature of society itself.

The opportunity and the need for strengthening the management of information have never been greater. Information technology permits greater flexibility to transfer, format, and utilize information. So often, we in Congress must respond to the problem of how technology has taken over human functions in our society, but information technology has created new functions, as well as new languages, and a new information infrastructure. The danger, of course, is that the tehcnology has outdistanced our ability to use it effectively. As technology development speeds forward, our ability to benefit from it lags far behind.

Are We Asking the Right Questions, and Are We Collecting the Right Data?

There are two fundamental concerns that I have with respect to government information: what questions should we be asking in order to make sound policy, and are our information systems well organized to give us the answer? The Congress, I believe, has an important responsibility to define the national interest in information policy and, where necessary, to address related implementation concerns.

An effective information policy is one that strengthens the guidance governing information collection, analysis, and dissemination, as well as the management of electronic information systems. For example, is our nation's trade policy based on the most useful and timely data? Is enforcement of the Superfund law being delayed because of needed improvements to the data collection or monitoring requirements concerning hazardous and toxic materials in local areas? Is the accuracy of our economic forecasting hampered because foreign language professional journals are either ignored or not understood?

Unfortunately there appears to be a growing body of evidence that suggests that our information systems are not that up-to-date. During the 1980s just when we should have been adding resources to our statistical systems, we cut them instead. As a result, many statistical agencies and activities have suffered cuts in the name of reducing the burden of government without considering the benefit of information in policymaking and to the public.

Economic Statistics: OTA Report

In 1988 the Office of Technology Assessment published a report, "Technology and the American Economic Transition," that discussed the ways in which new technologies have opened up new options for economic growth. I then asked OTA to review the

results of this study and provide a perspective of some of the areas in which better data would improve economic policy analysis.

The results of that review was a new report on economic data that demonstrates how staggering defects in the existing statistical system can hinder the understanding of key economic issues. Our economy is a rapidly changing one, and our statistical systems are not keeping up.

For example, we don't know with certainty how rapidly the U.S. economy is growing, which businesses are responsible for this growth, what impact international trade is having on domestic producers, workers, and consumers, what capital and labor inputs are purchased by domestic producers; how growth affects income and income distribution, and how growth translates into real improvements in the standards of living.

We certainly need to improve techniques for evaluating real growth in services. This would involve expanding our understanding of growth in such manufacturing areas as computing, semiconductors, and communications.

These challenges must be met in order to provide a better U.S. statistical system. To meet these challenges undoubtedly will require a coordinated approach by all branches of government. It will also require additional resources. This need for resources cannot be considered unless we are better able to set priorities for the U.S. statistical system as a whole. Unfortunately, a mechanism does not exist that can perform this function.

Education Statistics

Education information is another critical area we need to pay attention to. The quality of our children's education is one of the most important issues facing the nation today.

Fundamental to a realistic assessment of educational quality is an assesssment of U.S. education statistics and information-gathering efforts.

To the fullest extent possible, the databases that we have must be capable of supporting the public policy decision-making process whether it is at the federal, state, or local level. And now, as Congress, the President, and the nation's governors wrestle with plans for setting national goals and standards for educational excellence, all of us are asking the obvious questions about what we presently know about the performance of our students: What do we need to know, and what will we need to know in the future? What do we know about the performance of students in other countries? What is the federal government's role in finding out these facts?

Once again we have woefully little information with which to assess our children's education. The mechanisms to assess and monitor educational progress and the national information infrastructure to support those mechanisms are deficient. The National Center for Education Statistics, the primary source of federal data on American education until very recently, had been the target of budget cuts year after year, and it is still underfunded in comparison to other general purpose statistical agencies. The current vehicle for assessment, the National Assessment of Educational Progress (NAEP) tells us that nationally one-fourth of our seventh and eighth graders cannot add, subtract, multiply or divide whole numbers well enough to perform everyday tasks. But NAEP cannot tell us how kids in Albuquerque compare to kids in Santa Fe. And it cannot tell us what kids in either of these cities should be aspiring to.

Health Statistics

A third example I want to mention is health statistics. In a recent hearing my Subcommittee heard from Dr. Manning Feinleib of the National Center for Health Statistics (NCHS), which has also experienced funding cuts in the past and is expected to take another cut next fiscal year. As a result it may have to do away with a major health survey. Dr. Feinleib told us of several challenges facing NCHS today. One of them is measuring the health of special population groups. Morbidity, mortality, access to and use of health services, and health behaviour vary markedly by age, race, sex, and socioeconomic status. Recognizing these differences, many objectives have special population targets for minority groups. One example he gave involves the lack of data to reduce smokeless tobacco use among American Indians/Alaska natives. In many more cases there is little or no data on these groups.

Establishing a Commission on Federal Information

There are many examples that the federal information and statistical data system has not kept pace with changes in the U.S. economy and society. An in-depth

review is needed to ensure there are ongoing improvements within the system.

S. 1742, the Federal Information Resources Act, a bill I introduced to reauthorize the Paperwork Reduction Act, establishes a Commission on Federal Information to look at the broad question of the federal information and statistical system. The functions of the Commission are to look at the contribution of information to economic and social welfare and also to competitiveness, to identify long-term information neeeds, to identify gaps and other problems in the current system (especially with respect to quality, timeliness, and relevancy), to set priorities for information in light of changes in the economy and society, for better coordination and to ensure that the system is capable of keeping up with changes in the economy and society.

Some of these considerations may be worthy of examination at the 1991 White House Conference on Libraries.

The Management Challenge Ahead

In addition to the threshhold question of whether we are asking the right questions, there is the information management challenge that faces us. In the March 20, 1990 edition of the New York Times, there was an article entitled "Lost on Earth: Wealth of Data Found in Space." The article pointed out that "scientists seeking to mine the huge trove of data gathered at great risk and expense in 30 years of space flight have found that much of it is so badly labeled or stored that extracting useful information can require years of ingenious detective work. Clearly we need to be concerned with how the information is managed.

For government, the greatest challenges may lie in managing not only the ways in which information is processed, but also how it is used and how it is protected. In May 1989 during hearings that I chaired to examine "The Quality and Uses of Federal Information," Michael Boskin, chairman of the Council of Economic Advisors, provided an important perspective when he said, "While good, better, and more accurate information may not assure sound decisions in all cases, surely poor information clearly can only lead to good decision-making by accident."

The information infrastructure necessary to ensure good decision-making involves the coordination of a multifaceted federal information policy. Information collection and dissemination regardless of format, reduction of unnecessary and duplicative paperwork, statistical policy, computer security, privacy, records management, and much more are all facets of the information resources management challenge today.

The original Paperwork Reduction Act and my Federal Information Resources Management Act both address these issues. As the result of the hearings on this subject held before my subcommittee, as well as more recent hearings by the full committee, I have three distinct concerns.

First, I was alarmed that the information collection review process is not as effective as it could be in either reducing unnecessary paperwork burden or ensuring the collection of accurate and useful information. Second, I was concerned about the apparent absence of any overall government information strategy and became convinced of the need for an information policy that recognizes a comprehensive life-cycle management approach to government information. Third and last, I was concerned that the regulatory review activity of the Office of Information and Regulatory Affairs (OIRA) is all consuming, and furthermore has been characterized by unnecessary delays and a lack of accountability to Congress and the public.

S. 1742 addresses these concerns as well as the more traditional information resource management responsibilities assigned to OIRA.

Strengthens Paperwork Reduction Efforts

I believe the importance of a strong and ongoing government-wide effort to reduce the burden of unnecessary government paperwork cannot be overstated.

S. 1742 reauthorizes existing federal information collection provisions of law and creates a framework of agency responsibilities that range from burden reduction to form simplification. Furthermore, it requires OIRA to identify and evaluate initiatives designed to reduce paperwork burdens associated with individuals, business, educational institutions, state and local governments, especially with respect to procurement and federal grant programs.

Improving Information Resources Management

While unnecessary and burdensome information collection must be eliminated, the policy must not be a single-minded one resulting, ironically, in the reduction of useful information. Government information must be made a high priority as a valuable and useful

resource to government and society.

I believe that a better coordinated and systematic set of policies based on principles of information resources management will help provide more accurate and useful information, and perhaps help safeguard against the abuse of federal programs. OIRA, in conjunction with other government entities with centralized informatation management responsibilities, must take leadership in developing coherent information policy that gives balanced and needed emphasis to all information functions.

Status of the Legislation

S. 1742 will be marked up by the Governmental Affairs Committee on March 21, 1990. I encourage each of you to do what you can to support the legislation.

Affirmative Responsibility for Public Access

A third subject that needs to be part of the nation's information strategy is the affirmative responsibility for public access. It seems that our nation's laws governing information policy have not necessarily enabled our society to benefit from the advantages offered by the Information Age. I am concerned that the information mindset of the Federal government has resulted in widening the gap between the government and the governed, and that insufficient attention has been given to whether information is accessible to the public.

You may be familiar with many of the symptoms that have been most alarming:

- the OMB declaring a "war on waste" by conducting a wholesale elimination of federal publications;
- an executive order authorizing the reclassification of information already released to the public —and efforts by federal officials to actually reclaim material from libraries and researchers;
- the Department of Defense (DOD) stopping scientific conferences to review professional papers, require DOD approval for presentation, and requiring participants to sign an agreement controlling dissemination of unclassified DOD technical data discussed;
- hundreds of thousands of federal employees and contract employees required to sign nondisclosure and lifetime prepublication review contracts covering classified and "classifiable" information; and
- spiraling overclassification of government information coupled with elimination of declassification schedules.

All of this creates an unmanageable volume of information for effective security controls and jeapordizes the protection of information that truly warrants classification.

One opportunity in which I have had to address the issue of availability to government information refers to the information dissemination functions of OIRA. There is no description of that function in the original Paperwork Reduction Act. In hearings before my subcommittee, as well as in the literally hundreds of letters sent to OMB regarding its circular A-130, I became aware that the reauthorization legislation needed to help change our government's mindset about availability and access to information. In addition, while OMB's latest version of its dissemination policy seems to have begun to thaw the cold war on public information, still I saw the need to create a statutory framework and hence prevent a reversal in OMB direction. The truth is, OMB has not finalized any of the new proposals, and the December 1985 circular A-130 remains in effect today.

Here are a few of the ways in which the legislation promotes availability and access to information:

- The very first purpose reads: "To ensure the greatest possible benefit from information collected, maintained, used, disseminated, and retained by the Federal government.
- The OIRA administrator will be required to follow an overall framework in coordinating and providing guidance to agencies regarding dissemination. Such guidance "shall strengthen public access to Government information, regardless of format."
- The OIRA administrator must also coordinate plans for agency dissemination activity with other centralized information management agencies.
- The bill also makes clear that agencies, not OMB, have the primary responsibility to make decisions about dissemination activities, and, importantly, agencies are required for the first time in this law to establish a sound information dissemination management program.
- In each of the above areas, public access must be equitable and equal.

No one can question the right of the government to keep certain things secret. Weapons technology and deployment, diplomatic negotiations, intelligence methods and sources, and military contingency plans are among the areas where such protections are entirely defensible. Similarly, on the domestic front: personal data given to the government on the presumption it would be kept confidential — tax returns, personnel investigations, and the like — and official decisions that, if prematurely disclosed, would lead to speculation in land or commodities, preemptive buying, governmental costs, and private enrichment.

But it seems that the long range planning of how to develop useful information has given way to a predilection for either reducing it, eliminating it, or hiding it. There has been an insufficient emphasis on using it to our benefit. I hope that S. 1742, and the work of my subcommittee, will help change the mindset and allow us to benefit from the advantages that the Information Age has to offer.

Conclusion

Proverbs 29: 18, "Where there is no vision, the people perish," provides us a sense of the direction we may want to move in and a vision of where we would like to be. Without question Congress and the executive branch must provide stronger leadership, management, and guidance and conduct oversight to ensure that the opportunities of this Information Age are realized.

Federal libraries can be a great help in meeting the needs.

Managing Scientific and Technical Information in the 1990's

D. Allan Bromley
Assistant to the President for Science and Technology Director, Office of Science and Technology Policy Executive Office of the President

Unlike the Atomic Age or the Space Age, it is hard to pinpoint exactly the beginning of the Information Age. Nonetheless, the explosion of information is undeniable. Whenever I have any doubt of this, I merely have to look at my in-basket.

The free flow of information is central to the democratic ideals on which this nation was founded. Thomas Jefferson wrote, "If a Nation expects to be ignorant and free . . . it expects what never was and never will be." A modern corollary is that information plays a vital role in maintaining our national economic competitiveness. Derek Bok, while President of Harvard, summed up this connection well when he said, "If you think that knowledge is expensive, try ignorance."

It is appropriate that this forum takes place in the Library of Congress, the modern-day equivalent of the Greek library of Alexandria. I am reminded of the definition of a library that was popular with Yale undergraduates some years ago: a library is a book, followed by a book, followed by a book. These days, however, in view of the growing importance of digital information, one might need to modify that definition somewhat: a library is a byte, followed by a byte, followed by a byte.

Several years ago I did a brief analysis of the information contained in the Library of Congress and how it could be stored electronically. If you assume that there are 20 million volumes in the library, each on the average containing some 300 pages and 450,000 letters, the library then contains about 9 trillion letters, or about 9 trillion bytes—or 9 terabytes—of information. At that time, it would therefore have required about 20 IBM 3850 mass storage units to handle the entire library and provide almost random access to its contents.

What is more important, however, is that memory capacity has been increasing at a remarkably constant 35 percent per year for the past two decades. Even if we arbitrarily reduce this to 20 percent averaged over the coming century, we find that the same investment that would provide the 20 IBM 3850s to hold the contents of the Library of Congress would comfortably provide the equivalent of that entire system for each and every one of the world's citizens—up to a total population of 15 billion!

STI in the Information Age

The Information Age has resulted from the confluence of several technologies, including electronics, computers, and optical data storage and transmission. As such, we are still very much in its infancy. These forcing technologies are evolving at an accelerating pace and will create truly remarkable opportunities that, as a nation, we cannot afford to let pass by.

In retrospect, the rate of change of these technologies is truly astonishing. It is sometimes difficult to remember that, 100 years ago, electricity itself was little understood. Although Maxwell had predicted electromagnetic waves in his 1873 treatise, it was not until 1887 that Hertz first demonstrated their existence.

It was just a little more than 50 years ago that Aiken performed his pioneering work on the Mark I digital

computer at Harvard. Only a little more than 20 years have passed since the first fully commercial communications satellite, Intelsat I, was launched. Yet, today, the world is bound together in a global communications network and information has become one of our most important media of exchange.

Today I am going to be focusing on a particularly important type of information, namely, that arising from science and technology. Scientific and technical information (STI) has several unique characteristics. First is the character of the information, comprising three broad types—traditional bibliographic information, numeric data such as that arising from physical measurements or computations, and graphic images such as those produced by space-based observing systems. All of these types generally have distinct sources, separate formats, and often completely separate processing systems, but the trend is clearly toward electronic or optical systems that will store and transmit all three types.

A second distinguishing characteristic of STI is its audience. Scientific and technical information is used primarily by specialists. Relatively little STI is directly of interest to a broad audience, although summary conclusions or findings based on that information may be. Thus, the patterns of dissemination and the issues and needs regarding access to STI are rather different from information arising with, for example, census data.

A third distinguishing characteristic of STI is its sheer volume and growth rate. STI is the primary product of a major federal activity—research and development—in which the government invests about $70 billion per year. As a result, the federal government is the world's most prolific generator of STI.

The magnitude of science and technology (S&T) information is generally unappreciated. According to a recent report by the Office of Technology Assessment, the bibliographic federal S&T information base includes an estimated 4 million technical reports, a volume that is expanding at the rate of 200,000 new technical documents per year. Added to that are rapidly proliferating databases containing, in the earth sciences area alone, about 100 terabytes of numeric and graphic data, or more than 10 times as much data as in the entire Library of Congress.

By comparison, the database of the Social Security Administration, one of the largest nontechnical databases in the nation, comprises just 1.3 terabytes, or somewhat more than 10 percent of the total information in the Library of Congress. The U.S. Bureau of the Census estimates its 1986 digital database at 2.6 terabytes. Thus, the volume of STI is already one to two orders of magnitude larger than the volume of other kinds of archived materials.

Moreover, this staggering amount of information is a mere trickle compared to the flood of STI that is expected in the 1990s. Between now and 1998, a key National Oceanic and Atmospheric Administration (NOAA) database is expected to add some 200 additional terabytes of STI. Space-based systems are expected to send NASA ground stations more than 5,300 terabytes of STI. Overall, STI is expected to increase by two orders of magnitude—a hundredfold—during the 1990s.

Present STI budgets and technology do not even allow for such a quantity of data to be stored, much less efficiently managed or made available to intended users. Coping with a flow of such unprecedented volumes of information is clearly a monumental task.

Furthermore, managing science and technology information flows and storage is not enough. A number of additional issues deserve our attention.

Access and Dissemination

First of all, the existence of information does not guarantee its use. Data that are not accessible to scientists who need it or who are not even aware of its existence are of little value. Technologies cannot be transferred from national laboratories to private industry if companies, especially small companies, cannot discover its existence.

Some have pointed out the need for a national directory of directories of very large databases, a kind of electronic card catalogue comparable to the card catalogue of the Library of Congress. Also, the relative roles of federal and private entities in disseminating STI remain to be sorted out.

Information Literacy

As more and more STI is stored in digital systems on very large databases, the ability to search these systems becomes critical. Unfortunately, even many of our educators, scientists, and engineers are not literate in today's information technology and cannot exploit the results of our large national investment in research and development.

Also, the development of software has fallen far

behind the development of hardware and is now the bottleneck to more extensive and effective uses of computer technology. Here again, we have seen only the beginning of the tremendous advances on the horizon in the area of user-friendly software. As I have noted elsewhere, the morning you awake to find that your toaster is smarter than you are, will have deep psychological implications.

Infrastructure and Standards

In the area of database standards, it is important to note that there are more than 1,700 separate entities around the world that maintain at least one, and often many, data bases. But because of the lack of any agreed-upon standards, these data bases span a wide variety of systems, services, command languages, protocols, and terminologies. In effect, we are building an electronic Tower of Babel that will sharply limit the utility of these resources.

Foreign STI

Finally, the United States is not making effective use of foreign science and technology to enhance our economic competitiveness. Current efforts by federal agencies to collect and assess foreign STI are fragmented, with no central clearinghouse and no ready means for industry to access much of this information. The Japanese Technical Literature Program in the Department of Commerce is a valuable example of the efforts needed to remedy this problem, but not enough researchers take advantage of this service.

These are among the issues we must address if we are to gain the full value from STI and the greatest return from the federal investment in research and development. That return is vitally important. In an increasingly competitive world, our economic fortunes as a nation are closely tied to our success in translating new knowledge promptly into new products and services. To survive in the Information Age, we must learn to be information efficient, both in generating new information and in disseminating and using it.

The Role of OSTP

If STI is to be used to maximum advantage, the means and the institutional structures for handling STI within the federal government must be examined and a more coordinated approach must be derived. Traditional methods and arrangements may be ill-adapted to the need. The Office of Science and Technology Policy (OSTP) is now considering how such an examination might be put into effect.

One of the principal responsibilities of the Office of Science and Technology Policy is to review and coordinate federal research and development (R&D) that cuts across the missions of more than one federal agency. Since the effectiveness of that R&D may depend on scientific and technical information, there is clearly a role for OSTP in helping draw attention to and coordinate federal STI efforts. Indeed, the Office of Management and Budget, which has overall responsibility for federal information policy, has indicated a willingness to work with us in considering the special needs and circumstances of STI within the context of national information policy. So, it may be useful to present an overview of the role of OSTP in this administration and to indicate some of what we are doing in areas related to STI.

One of the primary ways in which OSTP carries out its mission to review and coordinate federal R&D is through the Federal Coordinating Council for Science, Engineering, and Technology (FCCSET), which was created by the same 1976 legislation that created OSTP. FCCSET is charged with reviewing and coordinating science, engineering, and technology activities that affect more than one federal agency, with STI a particularly notable example.

In the past, several FCCSET committees, such as the Committee on Earth Sciences and the Computer Research and Applications Committee, have demonstrated the great advantages to be derived from effective coordination of crosscutting issues in science and technology. For example, over the past several years, the Committee on Earth Sciences has organized all of the formerly disparate research on global change into the U.S. Global Change Research Program, which is now a coherent, government-wide approach to the scientific understanding of global change. Such coordination not only cuts down on duplicative research and increases the effectiveness of the research being done, but also gives particular areas of R&D increased visibility that can be used to emphasize important new initiatives in science and technology.

We are now in the process of revitalizing and reorganizing the FCCSET structure. We had the second meeting of the full FCCSET in mid-March. At both that meeting and the first meeting, we had excellent representation from the agencies, with cabinet secretaries

and heads of independent agencies constituting the majority of those in attendance. In general, we foresee a substantially altered and enhanced role for FCCSET within the White House. For the first time since the FCCSET was created, it should be functioning as it was designed to function.

FCCSET is now in the process of establishing and populating several umbrella committees in such areas as health and the life sciences and the physical, mathematical, and engineering sciences. Various subcommittees will be formed under these committees in such areas as materials science and engineering and, in particular, high performance computing.

High performance computing will also be a particular focus of the President's Council of Advisors on Science and Technology (PCAST), which the President announced at the beginning of February. PCAST held its first meeting at Camp David in February, at which high performance computing was one of the main topices under discussion, and the second meeting of the group was held in late March. The Council is a very forthright, as well as a very distinguished group, and I think we can be assured that the President will be well-informed about both the promise and the problems of science and technology.

I am the chairman of both PCAST and FCCSET, which gives me an opportunity to coordinate the activities of these entities. For example, we are now considering the prospects of setting up committees associated with PCAST that would parallel some of the committees under FCCSET. This would allow input to the FCCSET committees from the private sector to a degree that has not been possible before.

OSTP also is in the process of appointing an academic-industry panel on high performance computing with a chairman who is a member of PCAST. This panel will provide OSTP with an independent, private sector assessment of the progress of the program and advice on the integration of these technologies into the mainstream of U.S. science and industry.

High Performance Computing

OSTP has the opportunity to get involved in a wide variety of issues. Its priorities will change as opportunities and problems present themselves. At present, however, we are focusing on four main themes: education, economic competitiveness, global change, and high performance computing.

Virtually all of these themes involve STI issues in one form or another. I have already indicated that one of our key competitiveness issues is how to transfer newly created scientific knowledge into new products and services more rapidly and effectively. A major thrust of the Global Change Research Program is to gain a better understanding of how earth's climate system functions through expanded monitoring and modelling efforts. These efforts will contribute in a major way to the huge projected growth in numeric and graphic data that I described earlier. The FCCSET Committee on Earth Sciences has endorsed the work of the Interagency Working Group on Data Management for Global Change, which has dealt directly with STI issues that affect earth sciences. High performance computing will also generate large amounts of modelling data; but more importantly, this initiative will be critical to our ability to analyze, process, and communicate massive amounts of scientific and technical information. For this reason, it is perhaps most directly related to STI issues and deserves some further discussion here.

Last fall I sent to the Congress a report entitled *The Federal High Performance Computing Program*, produced by the Computer Research and Applications Committee of FCCSET. The program laid out by the report consists of four distinct parts. The first is developing the hardware that will, through the use of parallelism, make possible TERAOP computers operating at trillions of operations per second. The second is developing the software technology and algorithms that will permit full and efficient use of the hardware capabilities that are now and will soon be available. The third is building a National Research and Education Network (NREN) that will increase the accessibility of geographically dispersed users to supercomputers and reduce the incompatibility that now characterizes many computer networks. The fourth is training the personnel who will extend the tremendous advances that have been made in the past.

To further coordinate and increase high-level attention for high performance computing and to explore whether there exists a basis for extending the federal program into a national program, I convened a meeting earlier this year of agency heads and their deputy directors for R&D agencies that support high performance computing. A second meeting of this group was held in March and further meetings will be held as necessary. I expect that the result of this effort will be a far more coordinated program and budget submission for FY 1992.

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As part of the restructuring of FCCSET mentioned earlier, I am broadening the charter of the Computer Research and Applications Committee to include all aspects of information science and technology. I am presently considering whether this charter should also include STI issues, many of which, such as questions of standardization and the planning and management of very large databases, are closely related. An alternative approach might be to expand the interagency group known as CENDI (for Commerce, Energy, National Aeronautics and Space Administration (NASA), National Library of Medicine (NLM), Defense Information) into a full FCCSET committee. But whether through this mechanism or another, I believe that we must begin to address the issues posed by the special character and explosive growth of federal scientific and technical information. If we do not, we risk failing to reap the benefits of the emerging Information Age.

Problems and Possibilites

I indicated earlier that the emerging Information Age and the explosive growth of the underlying technologies is forcing rapid change, both for STI and in a wider context as well. Already, for example, sales of print and microfiche documents from the National Technical Information Service (NTIS) have declined 50 percent since 1980, while sales of computer products and online searching of the NTIS database via private vendors are growing. These changes will bring new problems, but will also offer a number of new opportunities.

At present, for example, demand among U.S. scientists for time on supercomputers is so high that time has to be closely rationed and many important investigations have to be postponed or curtailed. The absence of a high speed data network capable of rapidly transmitting the volumes of information produced by supercomputers adds to the frustration. Clearly, we are limiting the productivity of our scientists and undercutting what ought to a strong competitive edge for the United States.

Yet this situation is also an opportunity, if we can move rapidly to take advantage of it. According to a recent NTIS report, scientists in Japan who use supercomputers typically have access to at least an order of magnitude more time—a tenfold advantage over U.S. scientists. But relatively few Japanese scientists and engineers seek to use supercomputers in their work. We have shortages because far more of our scientists can and do use the power of supercomputers in their work.

In addition, we still lead in the design and development not only of supercomputers, which are increasingly critical to virtually every field of science and engineering, but also of powerful work stations and parallel processing computers. Exploiting that lead through programs such as the High Performance Computing Program is one of the ways to keep our R&D effort at the frontiers of science.

Research is not the only activity that could be transformed. Imagine how precollege science and math education might change if every child had access to a powerful but inexpensive work station and a large database of text and graphic information and educational programs, so that teachers could begin to customize the education of each child to suit his or her needs and automatically track the child's progress. Such an approach is technically feasible now and may well become economically feasible within the decade of the 1990s.

Imagine how publishing may change when periodicals can be customized for each subscriber to reflect his or her specific interests and can be delivered electronically, to be printed, if desired in that form, in the home or office of the recipient. Imagine how the role of libraries will change when most American homes are connected to libraries over local networks via a wide-bandwidth channel, such as an optical fiber or a cable TV conduit. Individuals would be able to search their local library or other repositories electronically to select and retrieve text and pictures, rent and view a movie, or research specific needs from recipes to home remodeling projects. Again, all of these are technically feasible today.

Imagine how much more efficient the federal STI efforts might be if data were archived on optical disks and could be searched and shared among agencies over a high-speed digital network using a common format. Imagine how professional work patterns may change when telecommuting, teleconferencing, and telecollaboration become even easier and cheaper than they are at present.

In this period of rapid change, the management of scientific and technical information must keep pace. We must vigorously explore the emerging new technologies and reexamine our institutional structures for STI. We must increase our flexibility to respond to new needs and new opportunities. We must give adequate

support to the planning and maintainence of our critical data repositories. Finally, we must seek to improve access to STI wherever possible.

A new phase of the industrial revolution is now under way, a phase that depends not so much on machines as on information. Our job is to see that the benefits of that revolution are spread as widely as possible.

Future Trends in Government Information Issues

Prudence Adler
Federal Relations Officer
Association for Research Libraries

I appreciate the opportunity to join with you today and congratulate the Federal Library and Information Center Committee (FLICC) on a successful 25 years. FLICC provides an important service to the library community and certainly to the federal government. Forums such as today's are an important means to advance the information policy debate.

Future trends in government information issues may change library services as we know of them today. I will try and speak to the vision that Dr. Bromley described. In that context libraries are I believe the "on ramps" to his superhighway network analogy. The difficulty of identifying future trends reminds me of the story of the legislator who introduced legislation to abolish the Patent and Trademark Office. He believed that everything had been invented, therefore, there was no need to maintain a Patent and Trademark Office.

In the information policy arena, we are seeing just how wrong that legislator was. In fact, the fast paced nature of technological change that he failed to see is one of the driving forces behind the information policy debate.

First, I will briefly review the role of depository libraries in providing access to government information and then review several key factors that are affecting public access to that information. These factors present new opportunities and place additional pressures on libraries in the delivery of information resources to the public.

As you know, libraries have been the primary channels of access for the public to information concerning the activities of government for well over 150 years. In the 1800s, Congress recognized a need for a means to make government information widely available beyond the seat of government. The need that Congress recognized is fundamental to the operation of our democratic form of government, namely, the principle of access to government information by citizens. Congress, by designating selected libraries as access channels, understood the role of libraries in our society as institutions that preserve and conserve our cultural heritage, provide educational resources, and serve not only individual interests but also the interests of the community in which they are located, and are an integral part of the social and cultural fabric of that community.

The depository library program established by Congress is a system with more than 1,400 participating libraries located throughout the United States in all types of public and private institutions.

This is a cooperative program between the government and libraries. The federal government provides the information to the libraries, and libraries in turn, provide no-fee access to their users. No other information provider offers such a service or has such a relationship with the government.

A recent survey of users of the program speaks to its success; 167,000 users each week benefit from the program.

It is the principle of access to government information that librarians and others seek to maintain as new technologies are introduced by agencies to assist with the collection, management, and dissemination of information. The need to access information is not dependent upon its form, whether it is a book, microfiche, CD-ROM, or an online service.

With this in mind, in 1987 the Association for Research Libraries in (ARL) adopted a statement of principles concerning government information in electronic format. These remain helpfu,l I believe, in guiding this information policy debate. The ARL principles are that:

- The open exchange of public information should be protected;
- Federal policy should support the integrity and preservation of government electronic databases;
- Copyright should not be applied to U.S. Government information;
- Diversity of sources of access to U.S. Government information is in the public interest and entrepreneurship should be encouraged;
- Government information should be available at low cost; and
- A system to provide equitable, no-fee access to basic public information is a requirement of a democratic society.

Many in the library community recognized new exciting opportunities available to libraries and to other providers with the introduction of the electronic technologies. I will touch on some of these activities later. What many in the library community find troublesome and currently are debating is the focus on costs related to access once new technologies are introduced.

This shift in emphasis to the costs of access stems from the appreciation that information in electronic format has greater economic value than on paper or microfiche. Whereas the earliest information debate was framed within the civil liberties context, the framework for the 1980s-1990s likely will be more within this economic perspective. That government information is now viewed as an economic resource in no way diminishes the need for the public to access basic government information.

Several factors have led to this shift within the federal government relating to costs.

First, the pace with which new technologies are developed, make their way into the marketplace, and are used by federal agencies, depository libraries, and the public has been unusually quick. As federal agencies invest in new technologies, yet another technology becomes available, introducing new services, new formats, and new cost considerations.

In addition, the challenge to make government information available in an accessible yet efficient format, while meeting the increasingly sophisticated user information needs, is one that many in and out of government look to the power of the technologies to solve or to address.

And finally, another dimension of the cost issue that grows out of these other factors is the debate about whether these systems provide cost-saving opportunities to the agencies and the user or whether new additional costs associated with information products and services could curtail or reduce access to government information. The principle of access must not be lost as we seek to resolve financial concerns. It is an issue with which we must grapple, so that we can move on and focus our efforts on utilizing the technology to the advantage of users.

The combination of these factors has had three consequences:

- First, it has led to congressional action to update existing statutes governing the new electronic environment;
- Second, it has placed additional pressures on depository libraries as channels of access to make information available regardless of format and cost;
- Third, it has prompted questions concerning the federal information system's current form.

These consequences are the focus of recent congressional activity on information policy issues. Work continues this session on: the reauthorization of the Paperwork Reduction Act, the Government Printing Office Act of 1990 that seeks to update selected chapters of Title 44 concerning the Government Printing Office (GPO), and examination of the National Technical Information Service, and the National High Performance Computing Technology Act, known as the National Research and Education Network (NREN) bill.

What does all the legislative activity mean for depository libraries? First, the shift to electronic resources in the federal sector signals that electronic products and service will become significant segments of depository library collections in the future. Second, under proposed legislation, there may be additional costs associated with the use of these information products and services. Third, libraries are turning to networks, bulletin boards, and the like to fully utilize these electronic services. This last point is a part of the changing paradigm of scholarly communication and illustrates how libraries are managing and organizing information in new ways to meet user needs.

Librarians are shifting resources within their institutions to accommodate new technologies and services. Historically, libraries have accommodated new technologies with ongoing services. In fact, that is already happening in many institutions, evidenced by the mounting of government data files locally, the

downloading of government bulletin boards so that researchers can manipulate the data with other information resources, and the accessing of data resources at other libraries via Internet. Internet is a network used by the science, research, and education communities. Within the ARL community alone, 30 online public access catalogs are accessible via Internet.

The combination of telecommunications technologies, plus advances in computing technologies, permit libraries more and more to become libraries without walls, and to rely upon other institutions for access to information resources. The concept of access to information resources in addition to ownership of resources is becoming more and more of a reality. With 1,000 books published internationally each day, 9,600 different periodicals published annually in the United States, and the total of all printed knowledge doubling every eight years, no single institution can house all available information resources.

Instead, the library community has designed numerous networks and cooperative programs to share resources and provide access to resources for scholars, researchers, and the public. Government information already constitutes a significant resource available through many of these resource sharing programs. Increasingly, libraries are able to use government information in new and different ways due to the power of new technologies.

I'd like to highlight a few examples of the types of activities emerging in libraries that combine government information with other resources.

- A database called PenPages, developed by the Penn State College of Agriculture disseminates reports and bulletins electronically for the Agricultural Extension Program. In one year, 57,000 messages were transmitted to more than 335,000 recipients. Users include farmers, businesses, and schools in addition to researchers at Penn State. The savings using electronic communication were estimated to be $250,000. PenPages has a public access bulletin board of more than 5,000 documents that is updated monthly, and is available 24 hours a day, seven days a week. No fees are associated with its use. Contributions to the database comes from 100 sources including the faculty and staff of the College of Agriculture, the U.S. Department of Agriculture, and the Pennsylvania Department of Agriculture.
- The Economic Bulletin Board of the Department of Commerce can be accessed for an annual fee of $25 plus the online telecommunication charges. The bulletin board provides the latest government economic indicators and other economic data. Libraries are downloading the entire file or parts of the file and manipulating the data with local online resources. Other bulletin boards cover education, energy, the environment, radioactive waste, census, and standards. The Economic Bulletin Board is part of the electronic pilot program available to depository libraries.
- An online publishing program within the Genome Project at the William H. Welch Medical Library at Johns Hopkins (JHU) has initiated, in collaboration with the National Library of Medicine (NLM), a new approach to the dissemination of research results. In this experiment text mounted in an online database is accessed by geneticists, students, and critics who respond via electronic mail to the author, Dr. McKusick. The result is a computerized textbook that constantly changes to reflect new advances in the field. The software supporting the experiment has been developed as part of the collaborative NLM/JHU Online Reference Works in Medicine Program.
- The National Agricultural Library (NAL) has sponsored a project with the North Carolina State university libraries to design an Internet based document delivery system for library materials. Scanned images of documents generate machine readable texts that are transmitted via National Sceince Foundation Network (NSFNET)/Internet to libraries, researchers' workstations, and agricultural research extension offices. Images of the documents can be delivered directly to the researcher's computer, placed on diskette or printed. An expanded, full-scale implementation text of the pilot is planned for 1990 through 1992, for up to eight land grant university libraries.

  By the mid-1990s, the project will include the entire land grant community utilizing the NSFNET/Internet, as well as other federal agencies, and the international agricultural research community.

These projects, I believe, demonstrate the potential for expanding access to government information while developing new and better uses of information. These are also programs that recognize the new economic value of information produced through science and technology research and its potential contributions to local and state economies.

Through the very introduction of these services, new pressures are placed on libraries— pressures to

purchase constantly changing technologies and software, to train staff in the use of new technologies, and to maintain collections that reflect a variety of formats. Libraries are facing these challenges creatively, through the use of computer networks and the development of new programs, such as described.

It is unclear, as these networks develop and evolve, what the financial implications are for depository libraries. What is clear is that computer networks have created opportunities to move large amount of data widely and at little cost. What is also clear is that the use of these networks will better equip librarians to assist users in identifying and accessing information resources. Our growing dependence upon networks and information technologies could require new models for the delivery of information to users. To reap the many benefits of emerging technologies, it is necessary to rethink the current means of delivery of government information via depository libraries to the public. The evaluation could address the advantages of the new networked system, as well as providing some relief to potential costs of access.

The traditional relationship between depository libraries and the federal government should not change with the introduction of these new technologies. Instead, new opportunities will be presented to libraries, to the government, and to users. Libraries will remain, more than ever, an essential link between the government and its citizens.

Most importantly, these activities illustrate the power and exciting potential of the technologies. They also demonstrate that as old laws are updated or new ones are established, there must be the flexibility to accommodate these types of activities, to permit experimentation, and to permit the open exchange of data.

Electronic distribution of information has the potential for significantly increasing the points of access, but only if we consciously design a system to that end.

I would like to close with a quotation that I believe could guide us in defining how to attain our goals of access to government information. It was said by Omar Bradley at the time the Marshall Plan was developed: "It is time to start steering by the stars and not by the light of passing ships."

The Future of the GPO Depository Library Program: Issues and Strategies

Charles R. McClure
Professor, School of Information Studies,
Syracuse University

If, as the theme of the forum suggests, "Access Is the Key," then one of the most important keys to providing public access to government information is the Government Printing Office (GPO) Depository Library Program (DLP). Some 1,400 depository libraries regularly provide the public with a broad range of govenrment information. Indeed, we know that there are at least some 167,000 users, per week, of just the academic and public depository libraries (McClure and Hernon, 1989a).

But as we move into the twenty-first century, it is clear that some careful thought and attention should be given to the future of the DLP. Its foundations, established by the Printing Act of 1895 and the Depository Library Act of 1962, show clear cracks. We must engage in public debate about restructuring and strengthening the DLP, and offer new and innovative policy initiatives if the DLP is to be an effective dissemination mechanism of government information in the future.

The purpose of this paper is to identify and discuss a number of issues that are likely to affect the future effectiveness of the DLP. In addition, the paper suggests some possible approaches that may assist us in considering future roles for the DLP. Some strategies are put forth to begin a process by which we can debate these issues and move the DLP forward into the twenty-first century.

Restructuring suggests a clarification or redefinition of DLP goals and objectives, new or different services being provided by the depository libraries, revised information dissemination responsibilities for the GPO and perhaps other federal agencies, a geographical rearrangement or redistribution of the depository libraries, and new relationships among the GPO, othr federal agencies, the public, and the depositories themselves. All of these aspects of restructuring must be addressed if the DLP is to be an effective provider of government information in the twenty-first century.

Recently, there has been much interest and debate regarding a range of information policy issues. But interestingly, this debate has inadequately focused on the future role of the DLP. As we approach the 1991 White House Conference, federal policymakers and interested stakeholder groups must give careful attention to debating these issues and defining a future vision for the DLP.

Key Trends and Issues

A number of key trends and issues are likely to affect the DLP's future. These include the following:

- *Increased Demand from Users for More and Better Information Services.* Depository library users are becoming increasingly more sophisticated about information technologies and the availability of information services in society at large. They expect the library to "keep pace."
- *Escalating Start-up Costs for Information Technologies.* For many depository libraries, the start-up and maintenance costs for obtaining the necessary information technologies will be prohibitive. There are likely to be increased disparities in the quality and types of services that the various depository libraries can provide.
- *Continued Pressures on the Federal and Library Budget.* At least in the near term, paperwork reduction and deficit reduction efforts will put increased pressure for cost sharing and user fees on various types of federal information dissemination activities. Spiraling costs for information re-

sources and regular "upgrading" of information technologies will also pressure library budgets.

- *Importance of Information Technology Management and Use Skills.* In both the federal agencies and the DLP, a significant effort will be needed to educate and train individuals to better utilize and exploit the available information technologies for improved dissemination to the public.
- *Increased Remote Access to Information Services and Resources.* The new information technologies, the development of national research networks, and more users with sophisticated information technologies will pressure the library to provide a range of remote services.
- *Increased Proliferation of Federal Information and Information Dissemination Mechanisms in Electronic Format.* Increasingly, federal agencies will be utilizing CD-ROM, bulletin boards, online databases, and evolving technologies. The degree to which these information resources will enter the DLP is unclear.
- *Private Sector Pressures for a Larger Role in Federal Information Dissemination.* New roles for the private sector in working with both the federal agencies and the depository libraries will be explored and developed. Adequate dissemination of federal information cannot occur without this involvement.

Indeed, the convergence of new information technologies and the development of a national high-speed electronic research network provides unique opportunities for improved access to and dissemination of government information (McClure, Bishop, and Doty, 1990a).

But within this context, we also know that institutional support for individual depositories over recent years has been stagnant at best. A recent survey of the regional depository libraries suggests that they are besieged with too many responsibilities and not enough resources (Kessler and Daniel, 1989). Agencies continue to initiate their own information dissemination programs and circumvent the Government Printing Office (GPO) in the printing and dissemination process. The Office of Management and Budget "believes it is not clear that agencies at present have a legal obligation to make electronic information products available to depository libraries" (1989, p. 25558). And a succession of congressionally mandated cuts at GPO has injured its ability to adequately support depository library programs and services.

The Office of Technology Assessment's *Informing the Nation* (1988) identified numerous electronic information products being developed and used by federal agencies. Yet paradoxically, the DLP is still only pilot testing the appropriateness of receiving electronic information products. Thus, the DLP has been hobbled from meeting the information needs of users requiring electronic information products—forcing those users into resolving their information needs through other dissemination mechanisms.

Numerous other issues and trends affecting the future role of depository libraries exist and have been discussed elsewhere (McClure, Hernon, and Relyea, 1989; McClure and Hernon, 1989b; and Hernon and McClure, 1988). Overall, these issues and trends suggest that there are numerous challenges to be faced if the DLP is to flourish into the twenty-first century.

The Changing Federal Dissemination Context

The issues and trends must also be considered within the historical development of the SLP (Hernon, McClure, and Purcell, 1985) and the changing dissemination context. There are three key aspects of this broader context to consider as we explore future roles for the depository library program.

First, the DLP has never been a centralized dissemination point; it is only one of many mechanisms that provide public access to government information *Figure 1* describes this broader context of decentralized government information dissemination, suggesting that many dissemination mechanisms are outside the DLP. Indeed, *Figure 1* does not begin to list the range of dissemination mechanisms (both traditional and electronic) that have been established by the government and private sector.

Equally important, *Figure 1* suggests that target audiences are more likely to rely on specific dissemination mechanisms. Yet, the DLP is thought to be a dissemination mechanism for the general public. Data from a national survey of users of academic and public GPO depository libraries suggest quite clearly that "users tend to be highly educated and can be characterized primarily as students and in professional or managerial occupation" (McClure and Hernon, 1989a, p. 44). Thus, one may question the degree to which the DLP currently serves all segments of the general public.

Second, in the design of information retrieval and

Figure 1
Information Needs Approach to Designing Dissemination Mechanisms

Target Audiences	Information Needs					
	Research	Government Agency Services	Popular Information	Health/ Safety Information	Statistics	. . . And Otehrs
The General Public						
Academic Community						
Consumers			Determine Appropriate Information Dissemination Mechanisms			
Research & Development Community						
Government Agencies						
Socially Disadvantaged						
. . . Other Target Audiences						

Figure 2
The Broader Context of Government Dissemination Activities

Target Audiences	Dissemination Approach								
	ERIC	NTIS	GPO Sales Program	GPO Dep. Lib.	Patent Dep. Lib.	State Data Centers.	Census Dep. Lib.	USGS Dep. Lib.	. . And Otehrs
Consumers									
Academic Community									
R & D Community									
Government Agencies									
The "General Public"									
The Voluntary Sector									
. . . Other Target Audiences									

dissemination systems, one typically begins by identifying user requirements and information needs (Dervin and Nilam, 1986). Then, one builds a system to meet those needs. But with much government information, many of the dissemination systems were designed originally to meet internal agency needs. Or, if designed specifically to mmet user information needs, inadequate attention was given to first identifying the needs of individuals within that target audience.

Figure 2 suggests the importance of carefully linking target audiences, information needs, and appropriate information dissemination mechanisms. But no government-wide assessment has reviewed or coordinated dissemination efforts with an eye toward identifying gaps and duplication. Such an assessment and review of the role of the DLP in the larger dissemination effort are needed. Further, greater attention must be given to designing dissemination mechanisms that identify and meet user information needs.

Third, there has been the historical perception that the DLP serves as the basic government safety net to guarantee some minimal level of public access to government information. But in recent times, numerous statutes include language that mandate agency dissemination of public information, e.g., P.L. 101-239 (1989), which creates the Agency for Health Care Policy and Research. This agency has the responsibility, for example, to (section 903):

- Promptly publish, make available, and otherwise disseminate, in a form understandable and on as broad a basis as practical so as to maximize its use, the results of research, demonstration projects, and evaluations conducted or supported under this title ...
- Provide indexing, abstracting, translating, publishing, and other services leading to a more effective and timely dissemination of information on research, demonstration projects, and evaluations with respect to health care to public and private entities ...

This, and other similar atatutes, serve to circumvent a central dissemination role of the DLP as outlined in Title 44 of the *United States Code*.

Hernon argues that there are numerous government information "safety nets," and that many of them are complementary (1990). In addition to mandated information dissemination activities (another recent example being the National Trade Data Bank [15 USC 4901-4913]), there are mechanisms such as public reading rooms in a number of agencies, the House and Senate Document Room, and federal information centers (to name but a few) that serve as government information safety nets. Further, these various government information safety nets respond to the needs of diverse target audiences and provide different types of information through a range of service levels.

In short, the federal information landscape is covered with a range of dissemination and safety net mechanisms—including the DLP. However, it is unclear which mechanisms are intended to meet which information needs of which target audiences. Over the years, the assumption that the DLP would serve as the basic safety net for access to government information has been eroded. A future vision for the DLP must take into consideration the cahnged dissemination context, the existing array of safety nets, and the federal and private sector dissemination mechanisms already in place.

A Range of Proposals

Over the years, there have been a number of proposals for restructuring the DLP. These have been summarized by Hernon and McClure (1988, pp. 365-390), who concluded, "the GPO's depository library program, as presently structured, poorly supports the dissemination needs of government agencies not does it adequately encourage increased access to government information resources: (p. 365). After reviewing the various proposals, they summarize and describe nine alternative models for the DLP:

- Centralized agency approach
- Information resource center approach
- Area regional depsoitory approach
- The voucher approach
- The commercial approach
- The sales depository approach
- The approval plan approach
- The comprehensive approach

More recently, in a study currently being conducted for the Bureau of the Census, these authors have identified additional approaches that may enhance public access to census data distributed through the depository library program. One approach, for example, could be a county extension ageny model where federal agencies support, on a regional basis, individuals who are especially knowledgeable about agency information resources and services and have been trained to

work as intermediearies between the public and the depository library (McClure and Hernon, 1989c).

The Association of Research Libraries (ARL) has proposed that depository library services be redefined so that some provide basic services, some intermediate services, and some full services (1987, p. 21) They go on to suggest that "a second kind of change that might take place within the program involves depository library cost-recovery for performing certain functions" (p. 21).

More recently, Informing the Nation (Office of Technology Assessment, 1988) proposed three possible alternatives for the DLP: the status quo, the electronic depository library, and the reorganized electronic depository system. Overall, the report concluded: "In the longer-term, Congress may wish to consider a reorganization or restructureing of the current depository program in light of electronic information dissemination options now or likely to become available: (p. 150).

The private sector has proposed that direct cash grants be made to the depository libraries "so that they might then acquire, from any appropriate source—including the private sector information companies offering such products and services at competitive market prices—some of the very information products these libraries believe would be so valuable to their patrons" (Congress, 1989, p. 94).

All these proposals require careful review and public debate. But the debate should include an examination of new roles and services for the DLP. For example, one may propose that the DLP shift from its role as a central dissemination mechanism for government information toward pointing or directing users to the appropriate government information dissemination activity or agency. Such an approach would be the Federal Information Locator System (FILS) for information *dissemination* rather than information collection (McClure, Bishop, and Doty, 1990b).

Despite the range of proposals and the general agreemtn from a number of stakeholders that the DLP is in need of restructuring, there has been little congressional attention given to the DLP. And the attention given to the Federal Information Resources Management Act (S. 1742 and H.R. 3695) and, more recently, the Government Printing Office Improvement Act of 1990 (H.R. 3849(does not encompass key issues related to the DLP. In short, there have been few concerted efforts to bring key stakeholders together to explore public policy issues and options related to the future of the DLP.

Facing the Future

The 1991 White House Conference can serve an important function by helping to draw attention to the role of the DLP and bringing together the stakeholders who might paint a vision for the DLP as it enters the twenty-first century. Indeed, the White House Conference has a number of objectives, but one key theme it intends to address is "how to help information users sift through an ever-exanding information supply, extracting what is useful, reliable, and timely" (White House Conference Set for July 1991," 1989, p. 831).

One of the most important areas of "ever-expanding information supply" is government information. For this area (and a number of other White House Conference themes) the DLP has a central and key role to play.

But there are other approaches to initiating public debate and discussion on the future role of the DLP. Key organizational groups, such as the Depository Library Council to the Public Printer, the Government Documents Round Table of the American Library Association, the Federal Publishers Committee, the Government Printing Office, the Information Industry Association, the Association of Research Libraries, Federal Information Resource Managers, and the Federal Library and Information Center Committee, could work together to orchestrate the debate and confront the issues.

Especially needed is congressional involvement. Key congressional leaders must be made aware of the importance of these issues. Staffers from the appropriate committees must be informed and asked to take a leadership role by defining the key issues; by requesting assessments from the Congressional Research Service (CRS), the Office of Technology Assissment (OTA), and the General Accounting Office (GAO); by obtaining input from knowledgeable stakeholders who are familiar with the topics. Ultimately, new legislation will be needed.

Toward this end, the following policy questions are offered as starting points for such a discussion.

- What should be the specific goals and objectives of the DLP as it enters the twenty-first century?
- Should the DLP be retained in the GPO, or are there other organizational structures within the government that might be considered?
- To which information needs and target audiences

should the DLP address itself?

- Are there too many or not enough depository libraries? Are they in the appropriate geographic locations and institutional settings given the objectives?
- How can depository libraries be better networked to each other and to other information resources and services?
- How can the DLP better coordinate its information dissemination activities with other federal agencies?
- What models can be proposed to share costs (not shift costs) for the dissemination of government information through the depository library program?
- What types of information (and in what formats) should be included for depository distribution?
- Should new classes or types of depository libraries be established?
- What are some possible models of effective cooperation and interaction among the federal government, the private sector, and the depository libraries that would enhance public access to government information?
- How can the DLP better exploit the available and evolving information technologies for enhanced public access to government information?

Undoubtedly, there are additional questions and issues. But public debate on these and similar questions is desperately needed to generate a new structure, role, and vision for the DLP as it enters the twenty-first century.

The discussion and debate of issues related to the DLP must be conducted in a setting that allows give and take among the stakeholders, encourages the presentation of innovative perspectives and ideas, and recognizes the changes and trands in the federal and societal information environment. The White House Conference, or any of the above-mentioned groups, must take a leadership position and orchestrate a review, discussion, and assessment of the key policy issues related to the future of the DLP.

Given the "window of opportunity" that is referenced in Information the Nation, it is time for the leadership vacuum regarding the future of the DLP to be filled. Any of a number of government agencies and congressional committees, library organizations, public advocacy groups, members of the information industry, or other such groups can, and must, orchestrate the development of this vision. We cannot allow the DLP to enter the twenty-first century in 1895 dress. We must all work together to debate, define, propose, and implement a new vision of a federal depository program that better meets the diverse information needs of the public.

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Access to Government Information: A Canadian Perspective

Brian Land
Executive Director, Ontario
Legislative Library

I shall be addressing the topic of citizen access to federal government information resources in Canada with reference to the three themes central to the 1991 White House Conference on Library and Information Services—information services for literacy, democracy, and productivity.

Literacy

I shall begin with a brief description of the illiteracy problem in Canada and efforts by the federal government to address this difficult issue. In 1987, the Southam Literacy Servy, carried out by the Creative Research Group Limited and funded by Southam Inc., one of the largest newspaper publishers in North America, estimated that 24 percent of Canadian residents 18 years and older were functionally illiterate. In other works, 5 million Canadians cannot read, write, or handle numbers well enough to meet the literacy demands of today's society.

One of the studies prepared for the Southam Literacy Survey of special interest to this audience dealt with the readability of Canadian government publications. It found that most government publications cannot be easily read or understood by the average Canadian. "The result," say literacy experts, "is that many Canadians aren't warned about dangers such as workplace hazards and can't benefit from government programs they're entitled to." Nearly half of the governemtn publications used in the survey sample requred university-level education to read, even though two-thirds of the Cnadian adults surveyed never got beyond high school. Even among fully literate Canadians, more than one in five reported needing help with such written materials. For example, seven out of ten Canadians could not use the tax charts to identify the correct among of federal income tax to pay. And a federal pamphlet on how to apply for a Social Insurance number rated a senior high school or college reading level.

In September 1987, the federal government announced the creation of a new National Literacy Secretariat to be responsible for research and policy development and to serve as a liaison with the provinces and volunteer groups. The Secretariat reviews all federal policies and programs to ensure these contribute to the national literacy strategy and also work with UNESCO and international nongovernmental organizations. The government has made available developmental funds to major community groups and research grants to national organizations involved in literacy programs. In addition to working with voluntary organizations and the private sector, the federal government has supported joint literacy initiatives with the provinces. In 1989-90, $23.5 million was allocated to the National Literacy Program by the federal government.

In 1989, Statistics Canada, the central statistical agency of the federal government, announced plans to undertake a National Survey on Literacy of Canadian Adults. This survey, to be conducted among 14,000 persons between 16 and 70 years of age, will make it possible to draw profiles of the literacy levels of Canadian adults.

The National Library of Canada is one of several government bodies participating in special programs for International Literacy Year. Among its plans is one to develop guidelines for assessing the readability of governemtn publications measured against the reading needs and literacy levels of the intended audiences.

Still, much remains to be done to keep illiteracy on the national agenda in Canada.

Democracy

I shall now turn to the theme of democracy and deal with freedom of information and other information policies and with the depository services program and electronic formats.

Freedom of Information Legislation

On July 1, 1983, the Access to Information Act came into force, giving Canadian citizens the statutory right to access records held by the federal government subject to certain defined exemptions.

As required by the act itself, a parliamentary committee carried out a comprehensive review of the provisions and operations of the act after its first three years. The committee published a report concluding that the legislation has "major shortcomings and weaknesses." One of the major problems recognized by the parliamentary committee was how little known the Access to Information Act is, both within government and among Canadians generally. Consequently, the committee recommended the act be amended to ensure that there would be provision for a public education mandate and for the education and training of government employees.

The parliamentary committee made a total of 108 recommendations in its March 1987 report, the most important of which was that Cabinet confidences, excluded from the act at present, be included "subject to a class-tested discretionary exemption."

Other recommendations of the committee dealt with such matters as the large number of exemptions in the act and the fact that so many of them may be invoked at the discretion of a government minister; the time delays in processing requests; the length of time the complaints procedure takes; the excessive fees; and the need to extend the act to cover all government institutions and offices directly responsible to Parliament.

The government of Canada published its response to the committee's report in October 1987 and rejected outright almost all of the recommendations. It stated that action should focus on administrative measures, such as improved training for government employees responsible for administration of the act.

Reaction to the government's response from the information commissioner, the officer of Parliament responsible for administration of the act, was strong and direct. the commissioner reported to Parliament that the government's response was "inadequate" and "inappropriate" and had "by inadvertence or design, undermined both the letter and the spirit of the Access to Information Act."

As one well-informed observer has written: "The message to Parliament, the media, and Canadians generally is that this government has a hard time living with access to information."

On a more positive note, the *Access Register*, with its companion volume, the *Index of Personal Information*, and two issues of the Bulletin published annually by the Treasury Board to assist the public in identifying government records will be made available online for public access and routinely updated by departments and agencies.

Other Federal Government Information Policies

There are approximately 10,000 requests under the Access to Information Act each year as compared to probably 300 million that the government handles in other ways. But one senior government official has estimated that "only 50 percent of current information holding in the government are sufficiently documented to satisfy all policy and statutory requirements." The government, therefore, has set about putting in place a series of information policies to remedy this situation.

One important component of information policy is the *Government Communications Policy* issued by the Treasury Board in July 1988. (Incidentally, the Treasury Board is roughly equivalent to the U.S. Office of Management and Budget.) Among other things, this policy addresses an important aspect of information management—the availability and dissemination of information.

The *Government Communications Policy* recognizes that the Access to Information Act "only complements and does not replace existing procedures for access to government information and should not limit in any way access to the type of government information that is normally available to the general public." However, the policy then goes on to caution government employees that "the provision of information is costly and should be under taken only where there is a clear duty to inform the public or where the user is willing to pay for it. The full cost of providing information to serve the proprietary interests of individuals should not be borne by taxpayers at large."

Another major policy, *Management of Government Information Holdings*, was issued by the Treasury Board in August 1989:

> The policy ... requires government departments to manage all information holdings, regardless of their form of medium, as a corporate resource and to maintain a centrally coordinated inventory of information holdings which is comprehensive, current, and structured in accordance with [each government] institution's programs and activities. The government is also committed to make the widest possible internal use of information by ensuring that it is fully indexed and accessible to those who require it, subject to legal and policy restraints. ...

The policy on Management of Government Information Holding complements other Treasury Board policies on access to information, privacy, communications, and government security. It constitutes one part of the three-part manual on government information management policy. The other parts, still to be published, will deal respectively with the managment of information technology (expected later this year) and with an "overview of information management that will include a short list of broad principles."

In summary, the Government of Canada has opted for a series of documents on information policy designed to complement one another rather than for an omnibus document.

The Depository Services Program

An important means of providing citizen access to government information is through the Depository Services Program. It is administered by the Canadian Government Publishing Centre in accordance with policies established by the Treasury Board, the most relevant ones being *Publishing* (1978) and *Government Communications Policy* (1988).

Through the Depository Services Program, the public is ensured of ongoing access to the federal government's publications. Currently, the program includes 52 depository libraries (one of which is the Library of Congress) and nearly 900 selective depositories consisting of public libraries and libraries of post-secondary educational institutions.

In order to achieve better liaison between the Canadian Government Publishing Centre and depository libraries, a Library Advisory Committee was established in 1979. In July 1989, the Advisory Committee set up a Task Force on Depository Program Review to assist the Publishing Centre with a comprehensive survey of participating libraries to determine whether the program is meeting its objectives in terms of service to the public and cost effectiveness.

The results of the program review are not yet known. It is known, however, that the Canadian Government Publishing Centre is examining possible major modifications to the present system, including the creation of basic core collections for different types of libraries, the establishment of subject profiles for more timely delivery of materials and better focused collections, the establishment of regional networks of depositories for more efficient sharing of documents, the provision of depository itms for the print-handicapped, and the inclusion in the program of machine-readable formats.

Federal Government Information in Electronic Format

Closely related to the future of the Depository Services Program is the issue of access to government information in electronic format. The present depository program applies only to print and microform materials at a time when the percentage of federal government information available in electronic format has been increasing rapidly. For example, a recent study identified and described 417 machine-readable files produced by the federal government. More and more frequently, government information that formerly was not available, or was available in print format only, is now accessible in electronic format.

Understandably, depository libraries have requested that electronic products be dealt with as part of the Depository Services Program. But, because of the higher costs involved, the policy of the government to date has been that, when there is no statutory responsibility to inform the public, users—and not the general taxpayer—should pay for the information.

Productivity

And finally, a few words about productivity and our ability to remain competitive in a changing world economy. The problem of defining the role of information in the economy has been examined in a series of three conferences involving the United States, the United Kingdom, and Canada.

At the final meeting in the series in 1987, the group agreed to a statement, known as the Glenerin Declaration, that provides guidelines and recommendation

relating to information distribution, efficiency, and protection. The preamble to the Glenerin Declaration states:

> We have moved from an industrial to an information age, where the efficient expolitation of information as an economic resource and as a sector of production has become crucial to the achievement of economic growth. ... The production, distribution and use of information have become matters of strategic, economic, social and political importance. To ensure that the benefits of the information age are fully realized, it is necessary to create and maintain an environment which provides for the open and unrestricted exchange of information.

The Glenerin Report observes that one particular responsibility of government is "to maintain support for the creation and provision of a minimum level of information available to, and accessible by, all citizens regardless of means."

Although its long-term impact remains to be seen, the 1987 Glenerin Declaration is a significant contribution to the goal of providing an international framework for improved access to information.

In conclusion, the major issues of access to federal government informaion in Canada are very similar to the ones with which you in the United States are dealing.

Introductory Remarks

David R. Bender
Executive Director, SpecialLibraries Association

The federal library community is an important element within the Special Libraries Association (SLA), for more than 13 percent of our 12,500 members work in the federal sector.

A new decade is upon us and soon, on its heels, the twenty-first century. In this rapidly changing society, the information profession has empowered itself and has done much to foster the notion that information is one of our nation's greatest resources. But we must ask ourselves, are we doing all we can to cultivate and utilize that resource to its fullest extent?

Lynne McCay, as SLA member who works at the Library of Congress, wrote in an article for SLA's journal, Special Libraries, that, "librarians—as seekers, handlers and purveyors of information—have known for a long time that information has value. The importance of information issues has gained more and more prominence in this Age of Information as leaders in education, business, and government have begun to measure the value of information."

I think we would all agree that we are deeply entrenched in the Information Age. We also live in the Age of Competitiveness—competitive intelligence, so to speak. Whether in the midst of a leveraged buy out or competing for a government contract, there is a need to be able to access government information in a timely and cost-effective manner. Obtaining such information has become increasingly difficult, with obstacles preventing or delaying access to reports, studies, and statistics that are, in fact, supported by tax dollars. The library profession, therefore, each of us, must be concerned with programs whereby public documents and government information are easily accessible and readily available to all.

Budget constraints, threats to national security, and exploding technological advances have dramatically changed the way in which the U.S. government has collected and disseminated its information. The 1980s ushered in a new administration that, over the course of the decade, constructed numerous barriers to the free flow of taxpayer-supported information.

The theme of this forum, "Access Is the Key," brings to mind a wide array of government directives in the last decade that did have or would have had a negative impact on the way government information was handled. Issues such as contracting our of federal libraries, the proposed and congressionally defeated privatization of the National Technical Information Service, imposition of access fees on enhanced service providers by the Federal Communications Commission, changes to the 1990 census questions, and restrictions on sensitive but unclassified information have been of great concern to the library/information profession.

In the past, Congress has examined these issues and certainly, in the case of NTIS, did stop the attempt to privatize that agency. Now Congress is beginning to take a look at contracting out, not just in libraries, but at the concept of the government "differing" to the private sector in performing certain commercial activities, as directed in the Office of Management and Budget's Circular A-76. Libraries and information centers, as this community is acutely aware, have been among those "commercial activities" that, in a number of federal agencies, have been contracted out. We remain "cautiously optimistic" as to whether this congressional review constitutes a reversal—even at such a slow pace—in the way the government has been dealing with

information access issues. The current administration may want to shed some of its own "points of light" on information policy issues and begin to break down some of those barriers to access.

In 1976, the Domestic Council Committee on the Right of Privacy, chaired by Vice President Nelson Rockefeller, presented a report titled "National Information Policy" to President Gerald Ford. In this era of constant technological advancements and innovative changes, it became evident that this critical area known as information policy required a fresh examination. In May of last year, SLA's 1988/89 President, Joe Ann Clifton, chaired a meeting of senior public and private sector leaders in the field of information technology. The charge to the group was to explore initiatives and identify priorities that required further examination and action.

It was determined at that time that SLA would host two additional meetings to further examine information policy issues. The second was to provide recommendations and the third to determine what might be done to implement those recommendations.

This past December 14-15, the second meeting, "National Information Policies: Strategies for the Future," was convened. More than 60 individuals from the library/information field, the information industry, education, government, and the public interest sector, heard a number of presentations, which included a review of the 1976 Rockefeller report. We then put the participants to work in small groups to discuss key issues. All of the participants reconvened on the afternoon of the second day to hear reports from the six working groups. A third meeting, to examine those recommendations and plot what course or courses of action to take, is planned for April 30.

As noted in the Forum Call, the speakers here today are examining the issue of access as we head toward the White House Conference on Library and Information Services, scheduled for July 1991.

I am pleased to note that many SLA members are heavily involved in planning for this conference at the local, state, regional, and federal levels. SLA's board of directors has gone on record in support of *the concepts and goals of a second White House* Conference. Some of the issues that address the need of our members, and the library and information profession as a whole, include:

- ways in which the library community can and should work with the private sector in the dissemination of government information;
- privatization and contracting out;
- the growing role of librarians/information specialists in the globalization of information;
- the important role played by corporate, federal, and other special libraries and information centers;
- strengthening public/private partnerships as federal funding for library-related initiatives dwindles;
- maintaining open access to government information to guarantee a democratic and economically sound society;
- protecting and confidentiality of library records maintained in public institutions;
- preservation of books and other publications; and
- marketing the profession and other resources offered by librarians and information specialists regardless of the type of library of information center.

The speakers on this panel will provide the library community's perspective, including public access to federal information, the view from the states, medical community, and industry, as well as the changing needs in information science education. Also, what is the role of the library community in this electronic age?

I would like to share with you a quote from T. M. Grundner in an article titled "manifesto for an Information Age," in which he examines the choices that must be made in shaping the development of the Information Age. He states: "Make no mistake. There will be principles and priorities; but without dialogue and decision, they will occur by default and surely a more thoughtful approach than that is in order."

The Medical Community's Views on Open Access

Gene A. Kallenberg, M.D.
Assistant Professor of Medicine and
Health Care Sciences George Washington
UniversityMedical Center

In contemplating my task of speaking on the "Medical Community's Views on Open Access," I chose to define access in a slightly different way. From my perusal of last year's Forum proceedings, I gathered that in the past this term has been used in the context of restrictions on the free flow of information and, further, that the adjective "federal" was frequently applied to both "information" and "restrictions." Fortunately, in medicine we are not so political, or at least not as overtly so, not so involved in issues of national security and the like that we run up against federal or other attempts at restricting access to federal or other kinds of information.

There are a couple of areas of exception to this statement. The first involves AIDs and the issue of required testing and the confidentiality of medical information. This is obviously a hotly debated and very complex issue. The second are is in the realm of environmental and occupational health. Certainly here we are all aware of the battles (with both federal and private entities) that have taken place with regard to access to information vital to the health of our citizenry, either in toto or in smaller groups affected by this or that episode of pollution or toxic exposure. Such situations are not my are of expertise, and I will not focus on them.

I choose to define and discuss "access to information" from two different perspectives: one, that of the patient and the other, that of the physician. First, the patient's perspective. I am a primary care physician whose job is to work with my patients to promote their health, prevent disease, and minimize the pain, suffering and functional limitations of their existing illnesses. Like Mr. Syms of the clothing business, I have realized that the best outcomes occur when I am working with an "educated" patient. Under such conditions the patient and I work together as equal partners. In this setting the patient does a good job carrying out the intended diagnostic or therapeutic plan because he or she understands the reasoning behind the recommendations. I avoid the pitfalls of paternalism and the patient remains in control and can better protect himself or herself from my human failings.

What makes an educated patient? Access to information. What kind of information? There are three kinds: information about how the human body works; the effects of the environment on its structure and functioning; the known methods of promoting health and preventing disease. All of these contribute to the person's health habits. This is a life-long educational and developmental process that for all of us, in my humble opinion, starts too late and with too little emphasis in our present educational system.

It is also a process in which such access to information and good role models of healthful habits is socioeconomically maldistributed. There are exceptions, of course, but I would contend that socioeconomically disadvantaged individuals have less access to information and education about how to lead healthful lives, and that this deficit is as important as their diminished economic means to accomplish such a goal. I believe that in our society, with all its technological and medical advances, this is one of the great remaining injustices today.

Returning to the wider general case for all of us, who is responsible for this process that results in an "educated patient?" After our parents, it is our school systems that are responsible for teaching health, and, from my perspective as a clinician, the quality of such education is certainly varied. Knowledge regarding

the effects of our environment—what we breathe, eat, drink, wear, and are exposed to—is increasingly under the purview of the federal government and its various agencies through their regulatory powers or their funding of basic research. This is also true of the knowledge base that has been developed about the methods for preventing disease as recently demonstrated by the publication of the recommendations of the U.S. Preventive Services Task Force.

The final product, our health habits (or, in a lot of cases, our unhealth habits) evolve as the result of complex interactions between personality, health beliefs and the teaching/role modeling to which we were exposed during our upbringing. Certainly our parents, teachers and friends, along with television and our government, all play vital roles in this process. Again, from my perspective as a clinician, such habits take years to make and are hard to change later.

Making health information more readily available to our citizens in increasingly convenient forms and with more democratic distribution is a job for people like those at the forum. Great strides are being made. My patients are now able to read important facts about the fat, salt, and calorie content of their foods. New federal laws prevent false advertising for over-the-counter products of questionable benefit. Patients are able to watch health shows on television and read informative health sections in their newspapers. They are able to obtain excellent written resources on exercise, healthful cooking and nutrition at their bookstores and libraries. Patient educators are growing in numbers and more physicians like me are recognizing the benefits of specific and focused patient education efforts to our patients' well being.

Where do we still need work? In two areas. As I indicated earlier, I think our elementary and high schools have to take a more serious role at teaching human biology. It just baffles me that we expect our students to master chemistry, math and the biology of plants and animals and yet allow them to graduate high school with medical theories about how their own bodies work that are weird enough to be worthy of that great Groucho Marx character from *Day at the Races*, the infamous Doctor Hackinabush. Most practicing clinicians could write humor anthologies of such beliefs and theories they have heard from well-educated patients. Human biology needs to be taught earlier and more completely with a goal of better understanding. There also needs to be an emphasis on prevention and early detection of our most prevalent and costly maladies—cardiovascular disease and cancer, both of which are frequently contributed to by our own bad habits, such as smoking.

We also still need better organization of clear and concise patient education materials for common medical problems. Much material is available from a myriad of sources, but the task of evaluating and organizing it is a time-consuming one for the private clinician. With input from the medical profession, public libraries could serve a valuable role in this regard. In the future it should be even more feasible to provide health education materials through the increasingly available online resource networks. Finally, as I emphasized before, a special effort must be made to provide such health information to all our citizens, especially those who are socioeconomically disadvantaged, because they are at even greater risk of falling prey to what should be preventable disease.

So much for access from the patient's point of view.

The second perspective on access to medical information is from that of the practicing physician. From this point of view the difficulty is not in having enough information. Indeed, we already have a surfeit of information, or perhaps a better word would be torrent. The difficulty is in organizing the torrent or being able to lay hands on the exact information appropriate to the situation at hand. Although it may be surprising to you, about a quarter to a third of my patient visits require me to do some sort of homework before I see the patient again. I either have to clarify something from the patient's record or, more often, obtain some additional information or knowledge before I can proceed appropriately with the care of the patient.

Traditionally, this search has involved checking the set of trusty medical texts in my office, discussing the situation with my peers or picking up the phone and getting advice from a consultant. Less often, possibly in part because of the effort involved, the question requires a search through the recent medical literature. This task involves looking through accumulated medical journals to which I subscribe, which are usually stacked chronologically on the floor of my office, and for which I, like every other physician in the land, have developed a special filing system. The alternate method of course used to be the Index Medicus. We used to spend (and still do) a lot of effort gathering information rather than processing it!

Much of this has now been made obsolete by Medline and its many variations. Indeed, the multiple ways to access the Medline database have been a great

boon to physician education and clinical practice. Our own George Washington University Himmelfarb Library's Minimedline system allows access to only the journals we have readily available on our shelves. This has some restrictions for researchers, but from a clinical perspective such a streamlining represents increased searching efficiency. The availability of such resources from home or office by dial-up allows the physician to ask his or her questions in a timely fashion, perhaps even real time, which means while the patient is still in the office.

The availability of CD-ROM technology allows easy transport of large databases such as those of Medline. Our library has a set of Medline CD-ROMs that allows endless searching to be done locally on a PC, thus obviating the charges associated with dialing up Medline. As costs come down, each reasonable size group of practicing doctors may be able to have its own CD-ROM copy of Medline. Furthermore, the ability of this technology to store images and sounds as well as text opens the door to the electronic textbook and other forms of computer assisted instruction (CAI) with ever more realistic simulations. Indeed, these methods are already becoming integral parts of medical education and the continuing medical education process.

Because of storage capacity alone, it has been estimated that the entire working library recommended for a practicing primary care internist's needs could fit onto a single CD-ROM. This sounds great until one contemplates how one must organize things to be able to access the right piece of this large database at the right time. This will require very complex indexing so that automated searching can be used to find all the relevant pieces of information necessary for an intelligent response to an intelligent question framed by a clinician user.

Requirements for such an accomplishment include natural language processing, artificial intelligence (AI), and the need for a unified medical language, the last of which is, in fact, the task of a specialized research group at the National Library of Medicine. But this is where medical information management is headed. The AI folks call it knowledge processing because it conveys a higher level of understanding and functioning than mere manipulation and formatting of data collections, which is the essence of mere information processing. It represents an understanding of the relationships between the information and the scientific theory that underpins or predicts how the information will turn out.

I was asked to envision the medical information needs of the next generation. Here is what I see. The effort of finding answers of the past will be gone. In the future there will be a seamless online resource web available to individual clinicians in their exam rooms. This web will be composed of solidified medical information (electronic medical texts and journals), collected clinical experience organized by patient (the individual patient record) and by groups of patients or populations of interest (national disease data banks), and ongoing research focused on the interface. For it is from observation of patients and what happens to them that we verify our present understanding of medical science, or realize that our understanding is inadequate and ask new questions that, in part, form the basis of the continuous process of medical research.

The elimination of the barriers between these three areas of medical activity—medical education, clinical practice and research—and their successful merging within integrated medical information systems will have great positive benefits to each and to the whole of the practice of medicine. Each clinician will be greatly empowered by the tremendously improved access to the collective knowledge base of medicine; each will be able to spend more time asking "Why?" rather than "Where can I find the answer to...?" and each will be more able to study the effectiveness of his or her medical practices. Indeed, the motto of the 1988 twelfth annual Symposia on Computer Applications in Medical Care was "Knowledge Is Power!"

Information scientists, librarians, knowledge engineers and computer scientists as well as medical experts will all play a role in this evolution. I feel privileged and excited to be alive during the time of transition to this new era. Its arrival will be as important to the future practice of medicine as were the development of the telephone and the automobile at the beginning of this century.

Public Needs for Federal Information

Elliot Shelkrot
Director, Free Library of Philadelphia

Top Bulletin: *Timely Information on Export Opportunies*–ceased publication in 1987. *National Register of Historic Places*–discontinued, although now available at cost from a private publisher.

Merchant Vessels of the United States, an annual listing of all United States merchant ships–not available since 1981. *Housing Finance Review* – now available at a cost of $84 from a private concern.

American Education–discontinued publication in 1985. A vehicle for showing off the federal role and interest in the field of education, widely used by many public libraries.

Pesticide Monitoring Journal–an annual list of the various residues and poisons in the food chain and in wildlife. Deceased in 1982.

National Monthly Medical Assistance–ceased publication in 1981.

Guide to Prescription Drug Costs–showing cost information for various kinds of drugs as well as FDA recommended doses, ceased publication in 1981.

GAO Documents–ceased publication in 1988. A very useful tool for many accounting firms and those watching the federal budget.

Fisheries Review–ceased publication in 1989.

Since the Academy Awards are coming up and people in our society tend to be more and more list conscious, and because lists appeared in magazines and newspapers showing the "ten top this" and the "ten top that," this is a list of the *Ten Top Federal Publications No Longer Available*, compiled by Bill Felker, head of the government publications department in the Free Library. These listed items are sorely missed by thousands of people who come to the Free Library of Philadelphia.

I share this list with you because of its diversity and because of the currency of so many of the items that are no longer available to the people we serve. I will use this time to talk about what the Free Library of Philadelphia tries to do and the issues with which it is concerned in the area of government publications. We are a large public library comprising 55 libraries throughout the city of Philadelphia. There are currently 790,000 people in Philadelphia with library cards, or nearly half the population of Philadelphia. These are people who have actually borrowed from the library during the last three years. Our circulation has increased, especially among children at 12 percent. Some 3 million reference questions have been answered by the Free Library.

We are a government depository library, although not a full depository. We are a selective depository, but my staff tells me that we select some 85 percent of those items that are available. We indeed have a fairly extensive collection, and our staff in our government publications department is about 11 people.

It costs the Free Library about half a million dollars to operate our government depository library right now, so we are not talking about a new concept of cost sharing. Those costs are already shared. What we are talking about is cost *shifting*, so a greater burden will be placed on the libraries providing the answers to the public, and of course, a greater burden to our budget under which we operate.

I would like to talk a little bit about my views of some of the challenges that we face, looking at it from a point of view of the diversity of the population we serve. I don't know how many of you are familiar with a book that I have recently found, a book called Information Anxiety, by Richard (?). This is a fascinating book not by an information scientist or a librarian. Information Anxiety is written by a gentlman who is a doctor of architecture, who has an approach to information which is absolutely fascinating, perhaps because of his training in architecture and looking at spacial relationships. As he explains in his book, the

spaces between structures and the relationship. He talks about information in a refreshing way and reminds us of many aspects of it that I think are very important. One of his themes is that in the whole concept of information we have lost a sense of the key word inform. The idea of information is to inform. He goes on to explain that that involves taking someone from one level of knowledge to another level of knowledge. As we provide information, we have to look at that individual's current state of knowledge, and what we can to as information specialists and librarians to taking the next step to another level of understanding. He is the founder of the term called "Access publishing." There is something very familiar in this book about the arrangement on the page. There is large print and small print. It is not just graphs, but it is a very pictorial style, always with summaries on the sides. In fact, you can read a summary version of the book by reading the table of contents, because there is enough information in it that you are learning something. I suspect from his point of view of taking someone from one level of knowledge to another, the best way for you to get from one level to another is in fact just reading that table of contents.

As I read a little bit more, I realized that Access Publishing House (which published the book) is the publisher of a book I used some summers ago called Paris Access. It is a very unique guidebook to Paris. You can follow though at whatever level of depth you choose to at a level of detail that you want. And by reading the table of contents and looking at the sidebars on the edges of the pages, and seeing diagrams and charts gives you a visual sense.

So the old concept of information and to inform, one element of it reminds me of how important it is that in our role, we find ways to help people inform themselves by going from one level of knowledge to another level of knowledge. With the diversity of people that come to any public library, that becomes a real challenge. We can have standing at the information desk an executive of Signet, the international insurance firm, or a homeless person trying to get information. We can have someone who has a PhD at the same time as an elementary student working on what is for us a rather simple question. One of the things we have done recently is how we interact with people. We are the link to access to all kinds of information. It is encumbent upon us to do that as well as we can. At a conference a year ago, sponsored by the Public Library Association, a division of ALA, my staff attended a workshop from the Professional Development Association of Maryland. The approach was picked up from the private sector and experimented and tested in Maryland in various libraries, and it is a rather simple, some would say simplistic, approach to being sure that you are in fact communicating and helping the user of the library move from one level of knowledge to another.

It involves four parts. An opening, a very specific phrase, a probe, a verification, and a conclusion. Some of the words and phrases that our staff is now using sound a little awkward, but what has happened as a result in that information exchange is just phenomenal. The opening is a very simple, "How can I help you?" The second part, the probe, is to get a more precise sense of what the question is. We aren't rigid about it, but we use something like, "What exactly can I get for you?" to narrow it down. These phrases have changed a great deal of the nature of the interaction with the public. A verification, much like the active listening that we hear a lot about, is a repitition in your own words of what the seeker of information has asked. And then a conclusion, which to me sounds very stilted, but by staff are now telling me it works miracles, and that is, "Have I completely answered your question." The reports from even the most reluctant staff are that somehow this process has, on the one hand, surprised everybody, and at the same time has presented ourselved in a much more open and a much more personalized way. We seem much more interested in that individual and their question, and therefore that individual has seemed much more at ease in asking their question in a way that is more accurate. One of the things in Information Anxiety is that it is difficult for people to describe their question, to explain what it is they are looking for. Perhaps one of the keys behind this theory is that it helps people explain exactly what they are looking for.

The next question is, how do we get to resources, how do we find what we are looking for? Government information is an essential commodity, if you will, in the function of a public library. We have now at the Free Library, in our attempts to communicate to people the extent of the library, we talk about the numbers of people in ways they can more easily understand. One that seems the most successful is when we talk about the 3 million people who turn to the Free Library each year, that is more than the combined attendance of the Phillies, Flyers, 76ers, and Eagles, somehow some people say "Oh, wow!

We have got to find ways of getting the information into our resources using the online system, the AIC Health System mentioned earlier–our central library people are loving that system because they can in fact search it themselves. Of course for us the fact it is on CD means no added cost, so let them search! It also provides a learning opportunity for them. We continue to look for better ways to provide information to the public in terms of the resources we have to make available, and the ways in which we handle those information transactions.

Since I started with a list of ten top items over the decade, I asked Bill Felker, What are the ten top things used from your department? I found some of them fascinating, so I am going to share them with you.

Obviously, federal reguations—often requested, including proposed and final rules.

Census data of all types—constant frequent requests.

House and Senate reports.—used by law firms.

Congressional Hearings—again used by law firms, looking for legislative intent. Also used by students because research can be done on various timely subjects.

Detailed daily and hourly weather data— once again used by attorneys trying to figure out just how foggy it was when a certain accident occurred, and other kinds of information. We get constant requests for exactly what the weather was like at a certain hour on a certain day.

Statistical information, especially the Uniform Crime Report—used very heavily.

I go through these mostly just to give you a sense of some of the questions that come to our government publications department, to indicate the reliance and the necessity for good, timely, and accurate government information.

The States' View of Access Issues

James A. Nelson
State Librarian, Kentucky

As we all muck about in the confusing swirl of information policy and practice, it seems to me that we have to hold onto a best-fitting metaphor if not a tailored paradigm in order not to lose our way. I found my fit anchored in an article, "Information as a Resource," by Harlan Cleveland. In this article, Professor Cleveland quotes from a 1930s poem by T. S. Eliot, "Choruses from the Rock," two lines that I use a lot these days: "Where is the wisdom we have lost in knowledge/Where is the knowledge we have lost in information?" While put somewhat plaintively, it seems to me that there is a lot in these two questions that should guide us all. If I may end with a preposition, that is, indeed, where it's at!

State perspective on federal information access is not a whole lot unlike other perspectives; we believe that all governments are accountable to the people, that all governments create a great deal of important, useful information, and that the people should have access to government information unless it is justly protected—the justice being determined by content and not format. We also know that life is not all that simple and that we have come to a point in our history where many issues must be resolved before we can determine whether new technologies will truly open more channels of access or close more down. I happen to be one who fears that the very technologies that we believed would widely open the doors to an information age are, in fact, shutting more people out, but that's not the topic assigned to me.

What may be a more relevant point for me to make is that state library agencies occupy a unique position in the information chain (a metaphor that fits well with the food chain concept). This position is even more interesting for those of us who are also responsible for records management and archival services, because, even though "public records" and "government documents" are not fashionable terms in these days of government information and information resource management (IRM), we are still talking about public records.

From a purely state library agency perspective, of course, we are concerned about how we can access federal government information to address the needs of state government and local customers through their closest library. This concern embraces challenging questions of integrating federal information resources into rapidly developing technology-based state networks. State government has taken on considerably more responsibility in all areas of public service as a result of the Reagan initiatives, and, with trends in information architecture migrating from highly centralized systems to desktop, state government is becoming a key player in the information business, too. The day of one-stop information shopping at your local library in not far away, and this does not just mean shopping for "library" materials. In this scenario, state agencies play an even more central role, because there are more relevant connections between the states and their local government entities than there are between the federal government and the states.

As we look to integrating federal information resources into our state menus, two principal issues drive our ability to offer a meaningful selection successfully:

. Will federal agencies plan and budget for dissemination alternatives as part of their IRM responsibilities?

. Will federal agencies engage state govern-

ments in a more meaningful collaboration on the data gathering side of the complex dissemination equation?

These questions, of course, run a parallel track at the state level, and I can assure you that not a whole lot of progress is being made back home.

What's clear to us in the government information business is that money, concept, and commitment are a long was off from having a meaningful impact on the first question. For a variety of reasons, government decision-makers have not yet arrived, and may never arrive, at the need to budget and appropriate funds for information infrastructures and services as they do for other government functions. Accordingly, there is an overwhelming trend towards the position that proclaims, "If people want to use government records in electronic formats, then, by damn, they will have to pay for them." (Every time I see five guys standing around a pothole on a public road I wish that information services were so flush, but then maybe I shouldn't) This troublesome reality seems to grow out of today's hip government MBA affectation that information is an asset and thus an attractive source of revenue. What I would wish is that we could see information investments more as requirements for efficient/effective government and an informed, productive society, but that will never happen.

State and local costs for federal information are sometimes a sore point, however, and it is often the state and local partner agencies who do much of the work in gathering the data that the Feds use. Beyond concerns about the cost of federally processed information, however, is the concern over usefulness of that information when it returns to state level. A contractor looking at state and local perspectives for the Office of Technology Assessment report that came to be Informing that Nation issued the following salient points based on his interviews with state officials. These points, I believe, speak to my second question about federal agencies engaging states in a more meaningful collaboration.

- Improvements to federal information dissemination cannot be achieved without considering the problems associated with federal information gathering.
- State administrators are less concerned with possible increases in their information costs than they are with possible reductions in their information labor.
- Compatibility and standards should be evolved from user needs, not imposed by federal decree.
- Federal information policy must accommodate the great diversity at state and local levels.
- State and local governments deserve special consideration commensurate with the special roles they play in federal information dissemination.
- State and local officials prefer small, well-defined changes based on specific needs to major federal modifications with far-reaching implications.

Finally, state planners need federal information that is more easily found, more easily accessed, more carefully documented, more timely, and more suitably packaged for their particular state.

The problem state agencies have with this second issue on gathering and disseminating federal information vary according to their relation with parent federal agencies and the nature of their shared mission. (If you really want to draw some fire at this point, ask the question of someone in the Human Service/Welfare business) The point is, however, that standards for dissemination of online and electronically published materials will not help build a more effective dissemination system if there is not a parallel coordination of federal information gathering practices as well.

By now it is probably clear that my remarks on "The States' View of Access" range somewhat abroad from what may have been expected of me. I think, however, it is important to keep an eye to the larger government information issues even as we focus on our Library and Information Center" special roles. Sitting on the Kentucky Information Systems Commission (which reviews information resource plans for all state agencies), I can assure you that there are a whole lot of people in the information dance who do not really realize that is what they have come to. Even if they understand that they should listen for the beat, chances are they won't be looking for a partner.

So, our concerns at the state level are like others in wanting greater access to federal information, wanting it in usable and "fresh" formats and wanting to integrate it into existing and developing

state networks. We would take one step beyond, however, and link the access question to the data-gathering process as well. To this end, we would seek more input from the information services community in the design stages so that end-user needs are addressed at that point. As it stands, states are generally faced with having to make sense from information processed for statistical systems and information systems that may be very useful to system operators while missing the mark at the end-user portion of the formula. This same concern is present in state and local government as well, of course, and I think it is incumbent on all of us in the information services end of the process to assert our point of view in future planning and development of the entire enterprise. Above all, we must jointly and collaboratively agree that we are not just talking about "library" issues anymore, and we must engage with the general information policy issues at every level of government.

Information awareness has grown dramatically with the advent of the new technologies, but this awareness tends to be driven by the new technologies rather than by why the information is needed and how it can be better used. Unless we look beyond systems and "library" problems, I fear that we may still be asking the questions posed by the poet more than 50 years ago when we reach the new century, and we will continue to scratch our heads wondering why we have not solved the problems we struggle with today. I choose to hold onto the reason for information (knowledge and wisdom) when I return to my own lair after trying to convince the decision-makers who are building Information Age governments without much success. It gives me strength and direction, so I end by suggesting that you all might want to do the same: find a metaphor, or at least some good questions, and continue the struggle.

What Industry Expects from Federal Information Providers

Scott Kostenbauder
Manager, Information Resources
IBM Corporation

My observations might serve to focus thinking and perhaps give some understanding of where industry is and where a lot of it is probably going in the use of information and how that affects all of us. Keep in mind that the following represents one person's opinion of the evolution of information use and the requirements in the 1990s related to industrial organizations.

I will begin by citing some measures of success that someone in industry who is involved in the use of information will strive to achieve in order to survive over time. The answer to questions of what service is to be provided or what results are to be accomplished is often stated as having the right information at the right place at the right time. These "magic three" are usually the stated goals of industrial educators as well.

These three "rights" appear to be laudable objectives. However, under questioning it is apparent that many goals are to be met as defined by an end-user professional, by an intermediary, and by the management of the company. Discussing the additional objectives that must be considered would be superfluous to the point I want to make. A list that represents the usual issues includes cost, media, context, users, quality, the organization, its goals, management/professional attitude, timing, and context. This is a much longer list than the three rights and highlights the complexity of understanding and solving information-flow problems.

Some of these considerations, such as cost, are relatively easy to analyze. For example, if large volumes of use are involved, company management will scrutinize the cost-benefit ratio of volume information purchases. This usually means that the people responsible for information delivery mission must scramble to show the effects and benefits to justify the expense.

For example, IBM's superconductivity breakthrough was attributed by the researchers to a clue found while browsing through a library. If this story had not made the popular press, few would be aware of the library's role. Other similar cases would not make visible any contribution or catalyst role of libraries and information services. Even the professionals do not always know where they found the critical pieces of information, and some of them forget the standards of quality research and documentation.

Management perception regarding the role of information and any use benefits varies widely by company, and even within a company in its various subdivisions. In the past, overt support was relatively easy to gauge by examining the size of the library, the staffing, and the total library budget. Of course, one had to be careful since some groups buy information directly from outside sources. The buying might be centralized or decentralized depending on each situation and organizational needs.

If one wants to know the buying pattern of industry, the issues of cost, use, media, etc. are a good starting point for a market analysis of potential buyers. If good answers are not found for these issues, then it is not likely a sale will occur.

Executives live in a world of decisions and responsibilities, and many recognize the value of effective information services because of frequent use. Unfortunately, such acceptance is not pervasive, or is it probably that it will be for many managers in the near future. This is unfortunate for numerous reasons.

However, there is a general belief, as stated in current literature such as "The Landmark MIT Study; Management in the 1990s," that information technology used well will be the competitive advantage of the 1990s. Not using it or using it poorly may kill the

company. The report concludes that to be competitive and successful in the 1990s, a company must do well all things that represent sound management, including the use of information technology. The MIT report states clearly and firmly that information use and technology are critical success factors.

Simple logic tells us that if the information flow continues to increase while library budgets and staffs are reduced, then information technology must be applied to assist or to automate user information tasks. Otherwise, the user is at an information disadvantage.

Recall that on the list of right results, organizational attitudes and structures and business goals are factors to be considered. What was not mentioned was the strong dependent relationship that exists among factors such as how the business is organized, what the business is, what its goals are, and how information technology is applied to support these and other strategies. Success in these endeavors is greatly affected by the vision and effort that management brings to the process.

When one wants a library to achieve success or the right results, there are a number of traditional actions to be considered, such as promotion of services, participation in user advisory groups, development of new book lists, executive support, electronic catalogs, enhanced interlibrary loan, etc.

These changes are enhancement of existing services. This list is probably similar to one that many of you might prepare. It would be an appropriate list for an evolving library plan preserving a traditional role and structure. These activities, however, do not represent the only path for tomorrow. In fact, operating mostly as a physical collection is an inadequate strategy—considering the need by an organization to achieve competitive performance. Not all organizations currently recognize this need, but they may need to do so to survive (in addition to other good management practices).

An alternative that is being pursued as a philosophy by the technologists in education and information can be termed a "performance support system," which I will refer to as a PSS. The user has access as needed to the tools of the trade, education, video databases, reference information, software, expert systems, communication, problem analysis tools, peer consulting via computer conferencing, and other kinds of information services. All these services must be integrated and easy to use. One can clearly see that electronic delivery mandates much more than conventional publishing as a source.

On the user side, there is a readiness factor. Most users are not ready to accept a sudden transition to full electronic services. Acceptance will come with time as more organizations are networked and use electronic mail, online retrieval, and other computer services. Some of you are in a new environment and are ready to accept some of the change, but many still say they want paper. It is an interesting conflict in human nature and, fortunately, it is one that will largely resolve itself with time.

My point is that some of industry and academia are ready and waiting for electronic information. Certainly federal information is used by many, or would be if it were in the electronic form that they now prefer.

The PSS concept has been around awhile and now appears to be a practical solution that will evolve during the 1990s. Many pieces can now be seen in companies with networks and the necessary computing power. Small organizations will depend more on approaches such as local area networks and CD-ROM. Large organizations may follow similar methods but can have the added advantage of centralized storage and processing linked to local area networks. Dr. Bromley said that small companies need to have access to information resources to aid innovation and competitiveness. Commercial services will benefit from the expanding business from companies attempting to compete effectively.

Elements of strategy as well as economics will play a great role in determining information technology design. Information suppliers will be required to meet the variety of media formats needed and suited to industrial applications. I'll say it again: Information suppliers must be prepared to meet the variety of media formats needed.

Printed materials will still play a role, but their identification and selection will mostly be an electronic process. Some of us are well on our way and want more.

Document image delivery will not be far behind in larger organizations. In IBM, 1.5 million abstracts a month are delivered as custom selected output to about 8,000 users. The users can electronically single-key order the documents desired. Copies of internal literature are printed automatically from an optical image system and mailed. Since all order processing is automated, a link to an image file is a small task—direct image delivery is near at hand, perhaps in 1990

on a limited scale.

The message is clear. Electronic media will become the media of choice for large organizations with these capabilities. Small organizations limited by the initial cost of big image systems will be able to carry out similar activities with small collections. This is not different from the size relationship of computers today. With time, low-cost massive storage will be available on small systems. It will just take more time for the technology to develop to a reasonable cost. The future is bright, but it does appear that the information-rich may get richer before information becomes everyone's tool.

A strategy that leads an organization to adopt technology as a supplement and perhaps as an eventual replacement for its physical library and paper information services is one that anticipates the results of innovation, design improvement, awareness, quality, and productivity. Experience shows that people who use information report time and productivity benefits from online and current-awareness profile systems. Savings occur with almost every use.

On the top side of this perspective is the process of innovation. Innovation, invention, and discovery are far less frequent per unit of information flow than awareness or the other effects on the list; however, the value, when it does occur, is likely to be much higher per single occurrence. It is possible that a professional in an information dependent position may approach a 10 percent time saving when using information technology. This saving may represent one in ten professional being freed to do additional creative work. The alternative information source usually also represents a considerably higher procurement cost. Add to this the new ideas developed and the case for use of information technology becomes very compelling.

Bridging the gap between organizational information systems and information developers will require some very creative approaches on the part of both commercial and government information developers. The desire of industrial users to have accurate and timely access to information must be addressed. This usually means weekly alert mechanisms and 48-hour cycle time on copy requests. The supply system must be fast and efficient, which probably means automated order processing. Some key considerations about the method and media of supply include coverage in key topics, common cataloging, multiple media, electronic handling, quality of abstracting, and foreign language coverage.

As mentioned before, key topic definition is beyond the scope of this paper. The processes, however, do create new demands upon the author: first, for better abstracts; and second, for better titling. In electronic delivery, user discrimination can occur on the title, and the second stage of selection uses the abstract. This is a clue for authors and editors. Accuracy and some detail are necessary in a title because electronic systems tend to present title lists for making selections from a search or a profile alert.

The users of government information are confronted by a wide assortment of agencies that are creating information. Therefore, especially important requirements are common cataloging and ordering processes. Standardization and having a single point of contact give total access, the theme of this conference.

Clearly, a master plan is needed for the structuring of government information output. A minimal approach might be distributing all print orders via the Government Printing Office and all database construction and image retrievable documents via the National Technical Information Service. It cannot be stressed too strongly that total inclusion in the NTIS database is the kind of access that allows electronic location of information in a single place. Even if the supply sources are distributed, at least the source should be identified in the abstract record. Several sets of databases will be needed for patents, publications, standards, and legislation.

What I have talked about today can be summarized by saying that the physical library is moving and will continue to move electronically to a user's office. It is not a question of whether it will happen, but how and when. Electronic approaches certainly can increase access to federal information by moving the library to the patron via electronics. The issues of the set of "rights" can be managed nicely by those of us who need to do so.

Online retrieval, ordering, and soon, delivery will close an access gap. The future can be now.

Information Science and Changing Needs

Deanna Marcum
Dean, School of Library and Information Science
The Catholic University of America

We have heard a great deal about the future trends: future trends in the provision of information sources and services as well as the future trends anticipated in the various user communities. While others have been talking about the future, the historian in me took a mental detour to 1923 when Charles Williamson delivered his report on "Training for Library Service" to the Carnegie Corporation. After studying the training programs available for librarians, he had this to say on the subject of advanced or specialized training:

> A point has now been reached...where there is apparently sufficient demand to make it feasible to provide specialized professional training. The rapid expansion of public and private libraries, the development of many types of special libraries, and a keen interest at the present time in higher standards of service, put a responsibility on the professional training schools of which they are becoming aware, but as yet they have taken no adequate steps to meet. (p. 92)

I began to think about this section of the Williamson report because it rather accurately sums up where library schools are today, some 67 years later. We recognize the need to provide different kinds of training for students who will be taking positions in different types of libraries, but the reality is, we still have not found a perfect way of doing it, especially in a one-year program. Many aspects of the profession have changed dramatically in the last few years, and we have added a number of courses to the curriculum, but the length and basic nature of the program remain unchanged. Despite the obstacles to making changes, we realize library and information science education must be modified if it is to flourish. I would like to reflect upon the changes that are taking place in libraries, and what those changes are likely to mean for library and information science education.

Fran Miksa, one of my library science colleagues at the University of Texas at Austin, pinpointed the fundamental change that has occurred in information seeking behavior in the modern age. He noted that individuals seeking information in the nineteenth century relied upon collections of materials. Reading was the primary form of information gathering. Compare this inner-drected activity with today's outer-directed methods of gathering information from many different media. In contrast to the nineteenth century notion of access on which so many of our library systems are based, twenty-first century access goals require collections that are access driven with demand priorities. The organization of information must be based on the individual query and necessarily linked to document retrieval. Clearly the students of today's library schools must understand that successful operations of special libraries, in particular, must begin with a knowledge of the information universe's inner workings. We must teach historical developments of library and information services so students understand this fundamental shift and appreciate the service implications of it.

Sadly, I have to report that many library schools have interpreted this mandate to mean we have to teach students about technology. How nice it would be if the solution were so simple. Technology will continually change, and students who learn one system today will not be prepared for the future unless they know how to translate what they have learned to subsequent generations of machines.

The real challenge for the library school is, what does the technology allow the librarian or information professional to do better because it exists? What infor-

mation resources are provided that are not otherwise available because technology allows access? The preamble to the law authorizing the second White House Conference on Library and Information Services includes the notion that expanding technological developments offer unprecedented opportunities for application to teaching and learning and to new means to provide access to library and information services. We all applaud that concept, but we must teach our students to evaluate technological products introduced into the marketplace based on what their potential is for meeting that goal, rather than on what the vendor tells us about the product's capabilities. To make such an evaluation, the student needs the analytical skills for making distinctions between what is needed and what is marketable.

Students must be educated well enough that they feel confident to make these judgments. In my view, a master's degree in library science (MLS) must be coupled with another advanced degree in a subject speciality in order for students to have that confidence. This is hard to accept among students now in library school who have used all of their savings to work on one master's degree, and I then begin to talk about the need for a second! But in the future, if the information professional expects to be a genuine collaborator with the researcher, or business expert, or the scientist, there must be more than a superficial knowledge of the substance of the other person's work. That can come most readily through academic preparation in that subject field.

Graduates from our library and information science programs must be skilled managers if they are to be prepared for the complex and demanding jobs awaiting them in the future. They must know how to evaluate methods and processes that are used to make information accessible. They must know about financial accounting so that information services are as cost effective as any other component of the organization. They must understand concepts of organizational design and development. Strategic planning and policy analysis should be familiar, workable concepts to any MLS graduate.

Nearly everyone who writes on this subject of what will be needed by information professionals of the future mentions the personal characteristics of flexibility and adaptability. We all recognize that students need to learn how to think so they will be able to apply what they already know to new situations. But how is this accomplished? One way of identifying prospective librarians with these skills is to rely on those now in the profession to help us recruit. From recent surveys, we know that most library school students have worked in a library or other information agency prior to coming to library school. In the process of doing a paraprofessional or clerical job in an information organization, they see what professionals are doing, and they decide that would be a good career choice for them. When librarians and information scientists encounter these young people with fine analytical abilities, it would be helpful indeed if they spent a little time with them explaining what the profession is all about, what changes are expected, and how the young person may think about being a part of those changes. Notifying library schools about such people will also help. All of us are quite aware of the need to do more in the recruiting area.

Ideally, library and information science students will be chosen as much for their people skills as for their analytical abilities, for the future scenarios require people with extraordinary interpersonal skills. If we agree that the new librarian must be the spokesperson for equitable access, the librarian must be a capable and forceful speaker, one who is respected by others in different fields. Negotiating skills, policy formation abilities, and lobbying expertise will be necessary in a way not heretofore imagined. This means, perhaps, designing courses that call for group process skills in addition to those that test the professional competence of the student.

The professional school differest from its university counterparts in that it attempts to socialize the student into a particular profession. Library school faculty attempt to perform this service by identifying practical and internship opportunities for their students. Librarians and other information professionals can provide an important service by calling to the attention of the faculty the opportunities available in organizations that would provide students with a very different look at the range of professional responsibilities. Library school faculty try to keep in touch with the latest developments of the profession, but desire and reality are not always perfectly matched. Practicing professionals should, I believe, also assume the responsibility of professionalizing our younger members. In practice, this means that librarians now at work in libraries and information agencies must take on a role in the continuing education of newly graduated students. The one-year degree program offered by most library schools is not adequate to prepare

students for the variety of work situations they will encounter.

Library schools have suffered enrollment declines in the past few years, and some have been closed by their parent institutions. We simply must make what we do more relevant to societal needs if we are to be credible. We also must stop believing that courses in microcomputers and CD-ROMs will be adequate. We are at a point where we must understand what information studies will mean to future generations and prepare our students to be leaders in that domain. It may mean that we have to take more seriously the mandate to recruit talented individuals into our profession. We in library schools must identify talented, energetic undergraduates and convince them that we have something important to offer. They need to know that this profession is working on the kinds of issues presented at this Forum.

The 1991 FLICC Forum on
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Building Information Superhighways: Supercomputing Networks and Libraries

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Summaries of Proceedings
and Papers

Federal Library and Information Center Committee
Library of Congress, Washington, D.C. 1992

Eighth Annual FLICC Forum on Federal Information Policies
March 20, 1991

Building Information Superhighways

Supercomputing Networks and Libraries

FORUM CALL

The National Research and Education Network (NREN) is a high performance computing network being proposed to support broadly communication and resource sharing among institutions and individuals engaged in education at all levels and scholarly research in all fields of knowledge. The vision guiding the evolution of supercomputer network initiatives like NREN is that of creating a nationwide system of electronic superhighways that can rapidly transport digitized information among the computers of geographically dispersed students, educators and researchers, and link them to a broad array of computer-based resources.

A substantial part of the value of such a supercomputer network will ultimately be derived from enhanced and increased access to a wide variety of information resources. While federal libraries can obviously play a central role in enriching the network environment, participation of the nation's libraries and information centers in NREN development has been little discussed. It is at forums such as this that the role of federal libraries and information centers in high performance computing networks like NREN can be better defined.

One challenge posed to the library community by the NREN-type initiative is how to make possible the creation of a "virtual library" comprised of a family of decentralized centers containing information resources in various forms, linked by common directories. Libraries are already beginning in providing expanded access to their online catalogs, with many library catalogs now accessible via networks. But to fully realize the vast information potential of a supercomputer network, much more will need to be done.

As NREN develops and its importance to the academic community increases, how can depository libraries and federal libraries and information centers most effectively participate? What impact will the use of NREN have on how libraries cooperate with each other and still provide adequate service to their patrons? What impact will NREN have on bibliographic utilities such as OCLC? How can federal libraries make sure that their voices are heard in the vital task of setting appropriate standards and policies for network-accessible information? What degree of responsibiliy will libraries need to assume for network management and operations? What new procedures will need to be developed and implemented for accounting, cost recovery, protecting intellectual property, and charging for the use of licensed products by libraries that function as service providers over NREN? Who will coordinate the functioning of a future "virtual library"? These and other issues that relate to building information superhighways will be discussed at the forum.

The Federal Library and Information Center Committee (FLICC) was established in 1965 as the Federal Library Committee to provide leadership in addressing policy issues that affect the dissemination of information to government employees and the general public. In line with this mandate, FLICC has arranged for forums on federal information policy, which have become an annual status report on information access and dissemination policies for the federal library and information center community and throughout the world.

Federal Library and Information Center Committee

FORUM ON FEDERAL INFORMATION POLICIES

Building Information Superhighways: Supercomputing Networks and Libraries

Wednesday, March 20, 1991
Mumford Room, 6th floor, James Madison Memorial Building
Library of Congress, First Street and Independence Avenue, SE, Washington, D.C.

9:00 a.m. *Registration and Coffee*

9:30 a.m. **Welcome, Introduction, and Program Overview**
Mary Berghaus Levering, Executive Director, FLICC
Donald C. Curran, Associate Librarian for Constituent Services, Library of Congress

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9:40 a.m. **Keynote Address:** ***NREN and Other Information Networks: The Federal Role***
The Honorable George E. Brown, Jr. (D-Ca.), U.S. House of Representatives; Chairman, House Science, Space, and Technology Committee

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10:00 a.m. ***Information Networks: A Vision of the Future***
Dr. Robert W. Lucky, Executive Director, Research and Communications Science Division, AT&T Bell Laboratories

10:30 a.m. *Coffee Break*

10:45 a.m. ***Part I: Current Initiatives and Future Prospects***

What is the NREN Initiative?
Dr. Charles N. Brownstein, Acting Assistant Director for Computer and Information Science and Engineering, National Science Foundation

11:05 a.m. **Key Issues For National Information Networking**
Presiding—Dr. Charles McClure, Professor, School of Information Studies, Syracuse University
Technical Issues—Dr. Fred Weingarten, Executive Director, The Computing Research Association
Governance and Funding Issues— Brian Kahin, Director, Information Infrastructure Project, Science, Technology and Public Policy Program, J.F. Kennedy School of Government, Harvard University
Legal Issues—Mark Rotenberg, Director of the Washington Office, Computer Professionals for Social Responsibilities
Operational Issues—Dr. Charles McClure

12:15 p.m. *Lunch (On Your Own)*

1:30 p.m. ***Part II: Federal Libraries and Information Providers: The Core of the Network Information Structure***
Presiding— Barbara Evans Markuson, Executive Director, Indiana Cooperative Library Services Authority
General Overview of the Library and Network Community's Role—Barbara Evans Markuson
The Role of National Libraries—Mary S. Price, Director for Acquisitions, Collections Services, Library of Congress
Future Directions for Federal Libraries and Information Centers—Pamela Andre, Associate Director for Automation, National Agricultural Library
The Library as Disseminator for Public Information—Francis J. Buckley, Associate Director for Public Services, Detroit Public Library

2:45 p.m. *Coffee Break*

3:00 p.m. ***Part III: The Larger Picture: Future Implications***
Presiding and Overview—Kenneth King, President, EDUCOM
Panel of Major Providers and End Users: A Selection of Perspectives
Education—Dr. Richard M. Dougherty, Professor, School of Library and Information Studies, University of Michigan
Research—Dr. Donald Langenberg, Chancellor, University of Maryland
Health—Dr. Donald Lindberg, Director, National Library of Medicine
The Profit and Not-for-Profit Sectors—Allan H. Weis, President & Chief Executive Officer, Advanced Network and Services, Inc.

4:15 p.m. ***Part IV: Approaches and Opportunities***
Presiding—Dr. Donald Langenberg and Barbara Evans Markuson

4:30 p.m. *Adjournment*

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Introductory and Special Remarks

Mary Berghaus Levering
Executive Director, FLICC

Donald C. Curran
Associate Librarian for Constituent Services, Library of Congress

FLICC Executive Director Mary Berghaus Levering welcomed participants with the reminder that the information superhighway is still under construction and "it is your observation and your participation as professionals that will help determine how and when it is finally completed."

She reported that during the past year FLICC has worked to answer a crucial question: "Will the federal library and information center community be a driving force in the system of electronic information superhighways for the 1990s, offering a model system of public access, or will the federal community end up bypassed by the fast moving technological breakthroughs of the education and research community?" With many anticipating passage of legislation establishing the National Research and Education Network, Forum speakers are prominent among those wearing the hard hats of superhighway construction as they refine national information networks in theory and practice.

Donald C. Curran, associate librarian for Constituent Services, Library of Congress, said the 1991 Forum promised to be as stimulating as the headlines the audience had been reading recently. He pointed out the possibilities supercomputers offer in conducting sophisticated research, detailing results from a current National Science Foundation project at Cornell University that apparently contradicts Einstein's general theory of relativity. He said, "The possibility in the future that such research and other studies can be quickly and easily shared on information highways across this country excites the library and information community." Curran introduced the major speakers and the panel moderators.

NREN and Other Information Networks: The Federal Role

Congressman George E. Brown, Jr.
Chairman, U.S. House of Representatives; House Science, Space, and Technology Committee

Educated as a physicist, Congressman George E. Brown, Jr. (D.-CA), predicted electronic data and its transmission soon will eclipse the printed word and its transmission. "We are all sitting on the bridge of that transition in human history," he said. Supercomputers have driven the development of the NREN, which he hopes will be a reality soon. The United States invented the supercomputer, but Congressman Brown expressed concern that the nation will lose its advantage in the on-going commercialization process.

To stay ahead of the competition from Europe and Japan, the United States needs to operate on two fronts. The first is the creation of a high-speed fiber optic network that will link researchers and educators in government, industry, and academia. That network is an infrastructure just as the highway and railroad systems are. Historically, the federal government has funded and shaped such infrastructures.

Congressman Brown said that an information network may result in totally new usages as it works to optimize research and enhance productivity. Infrastructures frequently bring unexpected results. The first railroads, for example, were seen as feeders to forms of water transportation.

The second front assures that the United States commercializes as well as invents, that the nation moves on to "secondary inventions," improvements and modifications of new inventions that establish continuing commercial feasibility. Congressman Brown called for an "ongoing federal research and development focus on scientific computer software, particularly for the exploitation of new supercomputer architectures."

He pointed out that the NREN will never be a fixed or final architecture, but rather operate as a dynamic and ever changing resource. It will serve not only researchers working on complex challenges but also educators and students seeking up-to-date information. "High performance computing is an enabling tool, a core tool," he said.

The way libraries serve patrons will change rapidly, but their function will not: "The libraries of the world are the embodiment of humankind's thinking through the ages. This will not change."

Information Networks: A Vision of the Future

Dr. Robert W. Lucky
Executive Director Research and Communications Science Division, AT&T Bell Laboratories

Inventor of the adaptive equalizer, Robert W. Lucky conducts research on

such new technologies as light-wave systems, multiprocessor computer systems, and new physical devices for optics and electronics. He serves on National Science Foundation advisory panels and is the author of *Silicon Dreams*.

Lucky suggested that it would be better to consider "Super Networks of Ordinary Computers," which is what most people use, rather than "Supercomputing Networks," which is what a few highly technical researchers use.

He favors the High Performance Computing Initiative and the proactive role of government. He finds "incredible potential" in the rapid advances in transmitting information. He calls the recent invention of the optical amplifier "a very significant invention that could change the landscape." It provides a thousandfold amplification of light that enables researchers to transmit pulses at a gigabit per second halfway around the world "without an electronic boost."

Libraries can't take advantage of this yet. The fastest speed now available—at great expense—is 45 megabits per second. When engineers have built a new infrastructure with the new broad-band Integrated Services Digital Network (ISDN), libraries will be able to use broadband rates in usable chunks. Lucky said that his goal would be ultimately to give customers gigabit rates for intervals as short as microseconds. Lucky said he could also foresee customers renting wavelengths, perhaps by a specific color, and creating their own networks from these new transmission pipes.

Currently narrow-band systems available are essentially one- dimensional, but bandwidth can open up two-dimensional opportunities that normally require great amounts of data, particularly images. With sufficient bandwidth you could even send three-dimensional video conferences. That may not be as desirable as it sounds. Lucky said, "Socially these don't work, at least not nearly as well as the futurists who haven't tried them think they do."

What he wants is library access—information moving through nothingness and being reproduced at the other end. One important way such information differs from a book: "I can give it to you, but I still have it."

One of the advances that will come will be increased storage capacity. Lucky said, "Nature seems to have placed no limit on how small information can be or how much energy is required to process it. ... It gets infinitely small, infinitely cheap."

With such massive amounts of information involved, the role of the librarian will be changing from curatorship to interpretation, Lucky predicted. He said libraries now are like computers; they don't know what they know. He visualized instead what he called the "Lucky Library," featuring professionals serving the public through a system with a hierarchy of card catalogues, "good stuff" readily accessible, and less useful information stored in "junk" basements and sub-basements.

The way it is now, Lucky complained, is that all the junk gets in the way of finding the good stuff. Perhaps librarians will have to take a more active role in making value judgements about what is junk and what is useful.

Part I: Current Initiatives and Future Prospects

Dr. Charles N. Brownstein
Acting Assistant Director for Computer and Information Science and Engineering, National Science Foundation

As the founding and current chair of the Federal Networking Council established in 1989, Charles Brownstein has worked to integrate federal research networking activities and to oversee the U.S. Internet.

Brownstein hopes that the President's High Performance Computing Initiative will lead to networks you don't need to be a specialist to use.

Scientists became concerned with computing and communications technology in the early 1970s. By 1985 it became obvious that many agencies could profit from using the technology collectively, and NSFNET was initiated to serve the research community.

"NREN now is a broad vision of a way to provide better service and advance research," said Brownstein, and budget requests reflect those two goals. The networking portion is about 15% of the entire UPCC initiative not enough alone to bring them to fruition. "This has to be done through partnership." The NREN program will organize the packet switch network, with the telephone companies functioning as carriers. Those companies and the computer industry are working on the software and hardware. The users and the information service providers will have to be the main providers of contact.

Libraries also are partners. Brownstein said that "some people are working with the library community doing experiments on digital libraries. That's the type of partnership we're going to need with the federal libraries."

Private but not all commercialized, the interim NREN has a pricing mechanism that "makes it easy

for you to use it. Your institution buys access through a network, usually a regional network, or from one of the many companies now that have sprung up to provide access to the network."

Other forms of commercial pricing remain to be decided. That will depend partially on growth. The present Internet connects a million computers in 50 states and in 35 countries, but the expanding traffic still is too small to appeal to the telephone companies.

Brownstein said, "We're working with those interested to construct an architecture, a "virtual" NREN that will consist of shared interconnected backbones and integrated services of some private, some public, some mission-specific, some NSF style general communities."

The U.S. Internet is moving away from dominance by federal agencies with money to spend on networking and toward those paying much of the cost; American research institutions and universities. Approximately 1000 campuses now are connected, and Brownstein urges each campus to set up its own network. In the next five years he hopes 17,000 school districts, 5,000 two-year pre-college sites, and 3,000 undergraduate and comprehensive institutions will sign on.

Also much advanced research, needed for "gigabit" speed networks is going on. On one such project, the federal government is providing approximately $15 million over four years; private industry; $100 million. In the next few years, much of the HPCC Networking money will go to putting the infrastructure in place. This is the time for federal libraries to become involved in the process.

Note: Dr. Brownstein's comments are drawn from a slide/transparency presentation based to a significant extent on the report *Grand Challenges: High Performance Computing and Communications. The FY '92 U.S. Research and Development Program.* Copies of this report can be requested from the Committee on Physical, Mathematical, and Engineering Sciences, c/o National Science Foundation, Computer and Information Science and Engineering, 1800 G. Street, N.W., Washington, D.C. 20550.

Key Issues for National Information Networking

Presiding—
Dr. Charles McClure
Professor, School of Information Studies, Syracuse University

Dr. Charles McClure, Professor, School of Information Studies, Syracuse University, presided over the afternoon panel on *Key Issues for National Information Networking.*

The Political Debate on Technical Issues

Dr. Fred Weingarten
Executive Director, The Computing Research Association

The constituencies for the NREN are becoming concerned about what it will be, and their concern is affecting the political debate, which has five dimensions.

The first is the vision, which is a continuum with two extremes: the techie (a network for specialists) and the universal (a network or National Information Infrastructure for everyone). Even individuals slide back and forth on this continuum.

Another is technology flow. The assumption is that technology will flow from the high-end users who stand ready to use the NREN to the community members who now don't.

The third dimension is the government's responsibility to support science and research, but as the network moves from techie to universal, the specter of social engineering arises.

Next is the mode of intervention, on the techie side, the government intervenes by funding the users, by working in a partnership that brings in the private sector.

The final dimension is constituency. The techies, numbering about 200,000, don't have as many votes as the 200 million potential universal users.

Today many groups differ on the definition of universal service and the need for it. Some lobbying groups argue the techie vision is just an excuse to build a big business- oriented service paid for by consumers. While NREN has had a polarizing affect, libraries sit between the two extremes and align themselves with various groups.

Political decisions soon will determine what happens to the technology. Some key decisions are: how is it designed, what are its uses, what is the purpose, who gets to make decisions?

Weingarten said, "There are two immediate challenges. One is that we not overwhelm the development of the NREN with over-expectations and over-demands. ... the second challenge is to make sure that as the NREN develops, it grows in a way that will encourage the larger, broader vision."

Some think of the universal vision as inevitable. Others believe achieving it requires conscious policy decisions.

Governance and Funding Issues

Brian Kahin
Director, Information Infrastructure Project, Science, Technology, and Public Policy Program, J. F. Kennedy School of Government, Harvard University

The National Research and Education Network is being developed in a larger communications and information environment which is in a state of radical change.

In the old communications and information environment there were a limited number of discrete, classical forms — common carriers, broadcasters, and publishers, each of these was associated with particular services (or products) and a particular set of policies. The computer revolution has caused a breakdown of these classical forms in a largely unregulated environment.

A similar phenomenon is happening within the present Internet, which not a network but an internetwork of autonomous networks. We have evolved from time-sharing systems (in the early 1960s) to singular networks (ARPANET) to the multiple internetworks that make up the current Internet.

Now, the model of a three-tier hierarchy that helped people make sense of the central NSFNET is breaking down. It is simply not possible to draw neat boundaries between backbone networks, mid-level networks, and campus-area networks — or the levels that identified below campus-area networks.

The NREN is actually less a network than a complex, multidimensial program devoted to: increasing performance ("the gigabit network"); increasing conectivity (adding new users and resources); and increasing functionality (software, supercomputers).

Furthermore, there are multiple policy objectives: the NREN is seen as a tool for existing programs and needs, a means for equitable access to shareable resources, and a strategic investment that will have many longterm payoffs.

An important feature of the Internet for libraries is the flat-rate pricing, which makes it much easier to budget than traditional telecommunications services and encourages equitable access.

This feature makes NREN especially suited to the dissemination of royalty-free information such as government information.

Privacy Issues

Marc Rotenberg
Director, WashingtonOffice, Computer Professionals for Social Responsibilities

Marc Rotenberg called the issue of the protection of privacy a "sleeping giant" of NREN development and a special concern to the library community.

The privacy law protecting recordkeeping systems and the law protecting communications traffic are converging, yet discussions have not focused on developing a network-wide policy on user confidentiality. Having fought successfully for privacy rights for transactional data, such as borrower records, the library community can help solve privacy questions for the NREN.

An initial step is establishing privacy policies in each library. Rotenberg also recommended that librarians contact the Intellectual Freedom Committee of the American Library Association, that FLICC create an NREN Privacy Task Force, and that the National Commission on Libraries and Information Sciences put privacy on its priority list.

Past Supreme Court rulings suggest that NREN privacy may eventually be established. In 1928, the Supreme Court had to consider whether there should be privacy protection for telephone communications. Justice Louis Brandeis wrote an opinion asserting that intercepting a telephone conversation was more an invasion of privacy than intercepting a person's mail which was unprotected by law. Justice Brandeis' views were later adopted by the Supreme Court. Rotenberg noted that today network communications generate more data than a phone call. He said, "One of the consequences is that each communication. Each inquiry to a database, provides extensive information about the user such as time and place of inquiry.

"Privacy protection for personal information is the key problem of the NREN." If the library community fails to solve the problem, the NREN's usefulness will be lessened.

Operational Issues

Dr. Charles McClure
Professor, School of Information Studies, Syracuse University

The lack of money to do everything for everybody makes it important for the

federal libraries and computing services to consider key operational issues.

A first issue is what the libraries' roles and responsibilities in the NREN will be. What services will an agency library provide and to whom? What training will be needed? Federal libraries need to determine the formats that will be most effective and what information is appropriate to access via the NREN.

Not all problems of providing access to printed information have been solved, and providing access to networked information will be even more complicated. One of the basic needs is to develop standards on a range of issues, including how federal involvement will take place, what kinds of information federal libraries and agencies might provide, and the degree to which it is appropriate for agencies to charge users to access such information.

"I am very concerned that from a federal perspective we have not addressed the difference between access to information and retrieval of information," McClure said. "Dumping information onto the NREN does not insure its retrievability. Retrieval will become even more difficult as information overload becomes heavier.

McClure recommended that FLICC and major agencies take a leadership role and develop "a comprehensive strategic plan of what to do, where to go and how to get there."

Ongoing education and training for federal officials in the use of the network will be "an absolute must," as will be a user-based research perspective in the design of network services.

McClure expressed concern about the possible domination of "bottom-line types." He said, "We have to resist the temptation of letting budgets and resources drive services and visions. The visions come first. Then we look to reallocate resources."

The development of the NREN presents the federal libraries with both a challenge and a unique opportunity to improve information resource management and the public's access to government information. Strategic planning to address these issues should begin immediately, he concluded.

Part II: Federal Libraries and Information Providers: The Core of the Network Information Structure

Presiding—
Barbara Evans Markuson
Executive Director, Indiana Cooperative Library Services Authority

Barbara Evans Markuson presided over the four-member panel of Federal Libraries and Information Providers: The Core of the Network Information Structure and presented the following General Overview of the Library and Network Community's Role.

The Library and Network Community's Role

Speaking for the average library network member, Barbara Markuson asked which users would be allowed on the superhighway and what the relationship between it and the existing library-based networks would be. Funding and the tidal wave of information have contributed to the tradition of resource sharing. In this development, the large national and academic research libraries traditionally have been the trend setters. Thus, they have lead in the interest in NREN.

So far, the NREN represents a large but "relatively contained institutional group—universities and research organizations." By contrast, library network organizations and systems generally serve diverse institutions, including federal agencies, school boards, corporations, and city governments. Libraries also develop local networks comprising diverse institutional groups.

Some hope that large institutions will be able to subsidize data transmission, but Markuson fears that mostly costs could close off the network to most libraries and their users.

Markuson also said most libraries are unsure about the infrastructure, how the governance of the NREN will work. Even as automation has enriched infrastructure in libraries, it has strained budgets and left comparatively little of the total library dollar for networking. She said, "Because of the growing imbalance between funding and need, we have applied networking resources primarily to reducing the rate of operating costs, improving the staff's productivity, and library sharing of increasingly expensive resources."

Through cooperative library networking such services as automated interlibrary lending have trickled down to most libraries. Non-likely networking groups are beginning to realize how much librarians have been able to do with relatively little funding in a few years. The need for extensive collaboration remains, however.

Libraries have been emphasizing productivity or the "work" side while the NREN has been emphasizing the "net" side, Markuson said. The two

sides need to learn from each other. Libraries have valuable experience in networking infrastructure on the national level. The NREN has made the most of coordinating access to computer resources in state, regional, and campus facilities. Libraries are vulnerable because they can't network to a significant extent at local and state levels. But the lack of financing for access beyond the broader education community cited make the NREN vulnerable as well.

Markuson said, "But the synergism between library networks and NREN could lead to an extraordinary new information infrastructure. It's essential to proceed with both groups' agendas without creating chaos."

One problem to face in networking millions of users is the lack of standards in both user access to library catalogues and in the many NREN database resources.

Libraries have tended to function in an ad hoc way, but this "adhocracy" leaves them open to change, including receptivity to the NREN as a patented new national library network infrastructure.

The Role of National Libraries

Mary S. Price
Director for Acquisitions Collections Services, Library of Congress

Henriette D. Avram, Associate Librarian; Mary S. Price, Director for Acquisitions, and Glen A. Zimmerman, Director for Technical Processes Research, Collections Services, Library of Congress, collectively produced a paper on the role of national libraries. In the absence of Ms. Price, Glen A. Zimmerman presented the paper, summarized as follows.

National libraries' roles differ around the world and within the United States. There are now slightly more than 100 national libraries born in three different generations. Approximately 20 classical libraries, including the Library of Congress and the Bibliotheque Nationale, were founded before and around 1800. Collections grew mostly because of forced deposit arrangements tied to copyright, and the size encouraged the development of bibliographic standards.

Approximately 50 second-generation libraries were founded by World War II, often as adjuncts to national governments. Many have scattered special divisions. Approximately three dozen national libraries have been born since World War II, and these are extremely diverse.

Common characteristics of national libraries include funding as separate entities and copyright deposit.

The Conference of Directors of National Libraries provides a forum for exchanging information. Many national libraries have exchange agreements to facilitate collection of other countries' official publications. The Library of Congress acquires 200,000 publications through official agreements with 69 countries. The Conference supports the Universal Bibliographic Control program, which produces standardized cataloging data in machine-readable form for the national bibliography.

The Library of Congress aims to catalog American imprints needed by American libraries. LC depends on other research libraries' and cooperative programs' contributions, including CONSER for serials, NACO for authority data, NCCP for monographs, and USNP for newspapers. LC also catalogs many non-U.S. imprints.

Another role of national libraries, in addition to preservation and exchange of publications and creation of bibliographic data, is providing access to bibliographic data and to publications. LC has been distributing the former through MARC for more than 20 years, first on magnetic tape and now also on CD-ROM and online. The MARC data also are exchanged internationally.

National libraries today lead in the area of standards, which are absolutely critical to the usefulness of large bibliographic databases.

The national libraries can be both participants in and users of national networks. Having this dual perspective should enable the Library of Congress to contribute to the establishment of a national network.

Future Directions for Federal Libraries and Information Centers

Pamela Q. J. Andre
Associate Director for Automation, National Agricultural Library

Pamela Andre pointed out that the National Agricultural Library functions both as a national library and a departmental library. As the latter, it has a more limited scope and far less funding than national libraries do.

Andre suggested that the departmental libraries' focus in networking should be on resource sharing and enhanced access. She described NAL experiences that could be models for the federal library community.

The first is the enhanced information center, "a proactive, nontraditional approach" that requires keeping abreast in order to "formulate materials on critical issues even before the questions can be asked." This involves outreach, identifying the audiences on an issue and establishing a working relationship with them.

The second is becoming a focus for departmental databases, enabling the libraries to identify and, through networking, make available state and federal government resources now not even identified. This often requires close collaboration with the research community. For example, NAL is using this approach on global change and plans to create a data management coordination center to provide improved access to data generated by U.S.D.A. research programs.

Commenting that scientists show little concern for disseminating findings, Andre said, "It is very appropriate for the librarians who are trained in the collection, organization, and management of information to bring those skills to the masses of electronic information that are being developed as part of government research activities."

A third area for libraries is enhanced access. Librarians are experts in finding information from printed and electronic sources. "But the locator tools and the access mechanism are brief, basic, and sometimes difficult to use," said Andre. Librarians need to take over from the techies and change this.

"People who can train and suggest are needed in this new electronic world," she said.

Andre called on the federal libraries to be a focus group for improving the use of the National Research and Education Network.

The Library as Disseminator of Public Information

Francis J. Buckley
Associate Director for Public Services,
Detroit Public Library

Francis J. Buckley said that libraries have many roles—educational, recreational, informational, cultural. "Today, most public and academic libraries are centers for lifelong information access for purposes ranging from education, business, community governance, scientific and technical development, or recreational reading."

To provide service, share costs, and broaden access, more and more libraries are being electronically linked into networks for support systems such as online catalogs or online circulation as well as for online access to informational databases.

One of the most critical information areas is public information, collected, compiled, and published in various formats by the government. Its value is being recognized, and competition to gain access to it is increasing. The federal government's traditional distribution and sales are being supplemented by private sector repackaging and distributing.

The Government Printing Office now provides microfilm and compact disks as well as publications to the 1,400 depository libraries scattered around the country in academic, public, and other institutions. Participating in the depository program is expensive for libraries, but they do so because government publications may be the only sources for information their patrons need. Pilot projects are testing various mechanisms for distributing electronic information to the depository libraries. Commercial services also are making government information available.

"The challenge is to provide access to all individuals at all levels of society. Many people may not have the funds to access information that's only available through commercial channels," said Buckley. The Office of Management and Budget is seeking to deal with this problem in the revised Circular A-130.

The Depository Library Program offers access to government information to citizens across the country in a network that could provide access to federal information via the NREN. Part of the NREN's function could be to link libraries and the public with government information.

Part III: The Larger Picture: Future Implications

An Overview

Kenneth King
President, EDUCOM

Kenneth King, presiding over this five member panel, said that the Interim National Research and Education Network is part of a large group of networks called Internet.

The goal is a gigabit research and education network that can transmit high resolution images and sound as well as text and numbers (multimedia information). It is expected that creating a network to which hundreds of thousands of information intensive scholars are connected will stimulate the commercial sector to create information services and

in the long term develop the technology necessary to deliver these services to every sector of society. These services delivered by broad band ISDN will form the cornerstone of the national information technology infrastructure.

Development has gone through stage one (1.5 million bits per second), almost completed stage two (45 million bits), and is working toward completing stage three (a billion bits) in 1995. Pieces are being spun off to the commercial world so the national information infrastructure can be established.

"The ultimate goal is to connect every scholar in the world with every other scholar, to get them all of the information resources and experimental instruments worth sharing connected to this network and to develop a knowledge management system that allows scholars to access this sea of resources in a standard, consistent, and intuitive way," said King. The workstation with multimedia capacity will be "the center of the universe."

Workstations will be linked to such functions as accessible data acquisition servers, cycle servers, output servers, and information servers.

Cooperative activities can build the infrastructure. It's also necessary to devise policies that ensure the widest possible access and protect both the public's right to information and the interests of producers. The library communities, King said, "have a particularly heavy responsibility to provide leadership and conduct experiments that show the way to others."

Balancing the E and R in NREN: The Educational Imperative

Dr. Richard M. Dougherty
President, American Library Association, and Professor, School of Information and Library Studies, University of Michigan

Richard Dougherty said that if the nation is to reach the six ambitious education goals set by President George Bush and governors, the National Research and Education Network must be a key piece of the infrastructure. Note: Dr. Dougherty's comments are drawn from the formal paper he prepared for the forum.

"The NREN has the potential to revolutionize the conduct of research, education, and information transfer," said Dougherty. Libraries will need the NREN in helping foster "information literacy" for all ages. Many public and academic libraries introduce users to technology, and libraries bring information not available in books to their patrons through technology.

In Michigan, community libraries are becoming mainstream information providers through a pilot project called M-Link that gains access to the University of Michigan Library through the state's MERIT network. The NREN could multiply the resources available to M-Link. In New York, the State Library is providing school systems with dial-up access to its own and 50 library systems' resources.

In academic institutions online catalogs have been a priority. More than 200 are accessible through Internet. More and more academic users will demand full-text databases and multimedia resources—with no meter running.

To organize the exploding volume of electronic information, librarians are pioneering in the development of electronic journals.

Users without an institutional base often depend on public libraries. Dougherty said, "The NREN legislation, as introduced, does not reflect current use of the networks, much less the full potential for support of research and education." Libraries outside academe have found creative ways to fill the gaps, including guest accounts at college libraries, community computer systems (e.g., the Cleveland Free-net), and the Silicon Valley Information Center.

The NREN could provide access in rural areas. Several states have set up networks to serve libraries in all areas.

Library networks provide a support structure for the NREN, for libraries have been pioneer users, developers of standards, and sharers of resources. The federal libraries using the Internet/NREN are logical vehicles for disseminating federal government databases, as are the depository libraries.

One danger is that academic libraries migrating to the Internet/NREN will be unable to communicate electronically with public libraries. Dougherty said, "In libraryland we will be in danger of building electronic railways of different gauges." To fulfill their mission, all libraries need to be able to share electronic information, including full-text resources.

Libraries also could provide a laboratory for eventual privatization of the network by serving as test beds. At the same time, public, school, and college libraries bridge the growing gap between the information poor and information rich. Because these libraries play such an important part in giving access to electronic information to all segments of the population, federal agencies alone should not determine policies. The legislation should ensure that the NREN is developed with connections in every state, allocations of funds for education and training,

and direct connections for at least 200 key libraries and library organizations.

If NREN facilitates synergistic relationships between research and education, it will play an important part in taking a networked society into the post-industrial world.

Research

Dr. Donald Langenberg
Chancellor, University of Maryland

Donald Langenberg said that the information explosion presents an unprecedented challenge in communicating developments to researchers. For example, the nation's medical imaging machines produce as much information in several weeks as the Library of Congress has collected in 200 years.

Technology has provided tools for performing every research function except thinking. Behavioral and institutional constraints pose larger obstacles than financial and technical restraints.

Information systems to support researchers must continue to form a support structure that stores information in accessible forms, allows them to communicate over space, enables them to manipulate information, and provides both human and non-human assistance.

These systems may look quite different from those in place. Langenberg proposes calling these "infory." Under this concept, the focus will go from the artifact (traditionally the book) to the content; and the term may apply to a place, a collection of information, or the workplace of the "inforians," professional information technologists. Langenberg said, "It is not intended to suggest a computerized library."

Langenberg sees infories today at about the stage automobiles were when they looked like horse-drawn carriages. He doesn't know what infories will look like later and expects they will vary considerably. "But every one of them must function as a node in that ultimate broadly interconnected network of information resources that, on the research side, are designed to support global research."

Development will be expensive. He thinks resources already committed to existing support systems will be used initially. As the infory evolves, so will the funding.

Information technology will bring radical change in everyone's life—after the development of much more hard and soft technology and the transformation of institutional infrastructure.

Health

Dr. Donald Lindberg
Director, National Library of Medicine

Donald Lindberg said that one of the big differences between today and tomorrow in the NREN will be the jump from a million to a billion bits a second. Yet we haven't learned to use 2400 baud lines properly or make them available to all. That's true for the general public and for medicine.

Librarians will make wide use of the NREN, but it wasn't designed by their orderly processes. It lacks governance, governing, and quality control. It's several thousand networks, and no one knows how much money is going into it. No one is putting in enough to control the budget.

Eventually it will be orderly, but librarians will be adopting new and different models of information-seeking behavior. That's happening at the National Library of Medicine.

It's not a matter of how to use existing supercomputers but of getting ready to use computers not yet invented that will serve networks not yet developed. Tax appropriations won't take care of all the costs.

The Profit and Not-for-Profit Sectors

Allan H. Weis
President and Chief Executive Officer,
Advanced Network & Services, Inc.

Allan Weis said that the gigabit-per-second NREN envisioned by 1996 has the potential to link not only researchers, educators, and librarians but also organizations ranging from small elementary schools to large fortune 500 corporations.

"Composite imaging and interactive visualization of computer simulations are emerging, and bandwidth-intensive, network applications," said Weis. Visualizing this data will help people understand its meaning and significance. The library and information center community have the skills to organize and merge this data in a useful way.

To be economically viable, the network must serve the for-profit and not-for-profit sectors as well as the users of the supercomputers. Network service

providers such as ANS have changed the way many institutions use the network, by broadening the base of applications used.

Three major changes will be in the funding paradigm for the network infrastructure (network service providers will gradually become self-sustaining), in the emergence of many new services (many more classes of users will find valuable tools), and acceptable use policies (more institutions and individuals will have greater access to the network for more purposes).

Productivity of "information workers" will soar. Access to needed information will enable people in both the public and private sectors to make better and quicker decisions than they can now. "Information management will be a major key to improving the gross national product in the United States," said Weis.

The use of paper will remain popular, but electronic storage will be key to improvements in information management. While we must meet technical challenges, the key ones include social, organizational, political, and financial challenges. "More data is not the answer; your skills are needed to make it accessible on a practical and economic basis," said Weis.

Part IV: Approaches and Opportunities

Presiding —
Dr. Donald Langenberg and Barbara Evans Markuson

Markuson said that the Forum showed that the approach to planning and building the NREN differs from that in the library community. The potential for collaboration is great, and some time remains to get the acts together.

Libraries should try to work on a larger collaborative scale and to speed up work on developing standards. Bibliographic control structures are particularly urgent. All of the library groups need to have similar forums on the issues addressed in this forum and related issues to develop informal opinions within our community.

Langenberg commented that what he had heard confirmed the wisdom of giving the NREN a users' orientation, of not making it just a network for techies. Another common point was the importance of open access, of open communication of scientific research to assist in other research. The NREN's global network gives an opportunity to democratize human knowledge.

Many expressed concern about who will pay for the networks. We have figured out how to support libraries and publishers, so we should be able to figure out how to fund information systems, Langenberg contended.

If federal librarians don't do what they can to take the lead and ride the crest of the wave, others will. Librarians can map the route if they decide to take the challenge. If they regard techies as a threat to be warded off, someone else will take the lead.

Langenberg predicted that in a generation the library profession will either be the one that guides and controls information systems or will be dead and gone. ■

NREN and Other Information Networks: The Federal Role

George E. Brown, Jr.
US House of Representatives

I am very pleased to be be here this morning to offer some remarks about a subject of long-standing interest to me, and I think I can add, of growing interest to others in Congress and across the nation. Information technology, information policy, and information infrastructure have become staple phrases in contemporary parlance.

The Federal Library and Information Center Committee, sponsor of today's forum, has had the same interest over the last twenty- five years. They have represented the federal information infrastructure since 1965 and they are doing a commendable job.

In today's society, we repeatedly hear the terms Information Age and Information Revolution. However, in reality, the history of mankind has actually been an information age. Man's fundamental need to communicate has taken many forms. Early man conveyed information by primitive cave drawings. The revolution of the various alphabets, the refinement of written language, and the advance of teaching and education through the copying of manuscripts are all manifestations of man's information and communication advances.

Concomitantly, technology has been the fundamental enabler for humans to supplement, amplify, and accelerate their inherent capabilities as thinking beings. The first major combinations of technology and information as a complex mechanical advance was the invention of printing by movable type in the mid-1400's. The process of combining the most advanced technology and the most advanced information is part of what this forum will be addressing today.

The era of the printed word and printing information—transmission is soon to be eclipsed by electronic data—transmission. We are all sitting on the bridge of that transition in mankind's history. All of you here today will help us make that transition to the new information threshold in the federal information system.

I hope that the National Research and Education Network is soon to be a reality. As all of you know, supercomputers have the development of this network.

Supercomputers were invented in America. The inventiveness of the United States in developing new technologies and techniques is well known and a matter of great pride. The loss of that initial advantage to another nation in the long-term commercialization process has also become well-known and a matter of considerable concern and debate.

High-performance computing is one high-technology field in which America is still generally regarded as a world leader. It is an important tool in scientific and engineering research and as a productivity enhancer in many commercial applications. For these reasons, it has been targeted for vigorous development by the Japanese and the Europeans.

In a market where the United States held a 100% market share, the Japanese have eroded that edge to only 66%. And the Japanese at this moment make the fastest single-processor super computers.

Monday's headline in *New Technology Week* announced, "European community looks into establishing a high-performance computing initiative of its own". A panel, set up to figure out what

the EEC should do about high performance computing, recommended a $1 billion a year investment to result in connecting the continent with a state-of-the-art network.

Our goal to stay ahead of the competition will operate on two fronts. First, the creation of a high-speed fiber optic network will link researchers and educators in government, industry, and academia, allowing over 1000 locations to transmit information in one second, equal to the entire Encyclopedia Britannica.

The network will be created with the active cooperation of the computer and telecommunications industries and with the goal of transitioning the management and operation of the network to the commercial sector.

The network is an infrastructure not much different from a highway or railroad transportation system. It will grow and evolve as needs evolve and change. Historically, the Federal Government has been a primary founder and shaper of the nation's various infrastructures. The creation of an information network is less tangible than the geographic positioning of roads and tracks. Thus the concept of federal responsibility for shaping and supporting such an infrastructure requires a new perspective.

The chairman of the Federal Communications Commission, Alfred Sikes, said in a recent speech, "In yesterday's world, those who had status, wealth, or were fortunate enough to control a key natural resources had economic power. Today, and increasingly tomorrow, that power will be diffused. Power will follow the skillful use of information."

Although we think we can visualize and anticipate the myriad uses of this network for optimizing research and enhancing productivity in commercial application, we should be prepared to be startled by totally new usages. There is clearly insufficient appreciation of this new force of information processing and application. Historians of the "diffusion of technology" delight us as well as forewarn us of some surprises.

In *Perspectives on Technology*, Stanford University Economics Professor Nathan Rosenberg tells us, " Railroads were originally thought of as essentially feeders to canals and other forms of water transportation. In the early days of radio at the turn of the century, it was regarded primarily as a supplement to wire communications services, to be used only where wire was not practicle—as in certain isolated locations or for ships at sea. Finally, even so versatile an inventor as Thomas Edison is said to have thought that the phonograph would be useful principally to record the wishes of old men on their death beds."

I said that our goal to stay ahead of the competition would operate on two fronts. The first was to set up the National Research and Education Network to propel our scientific and engineering research beyond our competitors. Here we fulfill the primary purpose of utilizing any new technology. It enables us to do something in a new way, or in a faster or simpler mode.

The second function of technology utilization is the continuous process of modification and improvement. Our second front is designed to help prevent the "deja vu" scenario of "invented here but commercialized elsewhere". As I mentioned earlier, the United States has a fine reputation and record for invention, and much poorer record for prevailing the long-term commercialization.

There is process after initial invention that some economists and technology historians call "secondary inventions." They are essential design improvements and modifications that we often tempted to dismiss as less important than the initial technological breakthrough. Economists document that there is no good economic reason for this dismissal. In fact, it is precisely this later work that establishes continuing commercial feasibility. Hindsight teaches us by repeated experience, especially with the Japanese, that we have made most of our failures in this realm.

The place of technology change in high performances computing is very rapid and we cannot for a moment be complacent. Our second front will establish an on-going federal research and development focus on scientific computer software, particularly for exploitation of new supercomputer architectures. The program will encourage the development of new generations of supercomputers, including the installation of early production models in our federal labs. The object is to continuously expand the "secondary invention" stage. This will not only help insure that we remain competitive in the fast-paced high performance computing market, but eventually it will provide the potential for leading to another, unimagined breakthrough.

Let us say that the National Network that most of you will both help shape and then utilize is not intended to ever be a fixed or final architecture. Instead, it will operate as a dynamic and ever changing resource with unlimited potential.

The diverse capabilities will be useful for all researchers, not just for researchers working on the Great Challenges of global weather or black holes. The Network will be a practical mechanism for colleague collaboration across every sector of our economy. It will function as an educational tool that never becomes out-dated or obsolete like so many of our textbooks and films.

High performances computing is an enabling tool, a core tool. It has the fundamental function in a high technology society that gears and fulcrums served at same capacity, it will act as the enabling force for thousands of new capabilities, none of which we can now name.

The Library and Information Center Committee and all of the institutions it represents will be part of these expanding opportunities. The libraries of the world are the embodiment of man's thinking through the ages. This will not change. The pace is going to accelerate and the process of serving patrons will differ in the future. Your importance as a lively resource can only expand.

Future Directions for Federal Libraries and Information Centers

Pamela Andre
Associate Director for Automation
National Agricultural Library

Henriette (Avram) has given an excellent overview of the role of the national libraries in national networking and the establishment and utilization of the NREN. You are probably asking yourself what I could possibly have to say from the perspective of the smallest and least well known of the three national libraries.

What may surprise many of you is that NAL wears two hats, that of the National Agricultural Library and also that of the USDA Departmental Library. It is from the perspective of this latter role that I formulate my remarks today. I believe the departmental library role we have parallels very closely the relationships that most federal libraries and information centers have within their departments.

So given the fact that we departmental libraries are smaller, have more limited scope and far less money than the national libraries, what roles should we be playing in this new networking world?

I would suggest that the focus should be on resource sharing and enhanced access. The idea of resource sharing is for the group of cooperators to do more with less. Libraries have proven that this is possible many times in the past 20 years, as local and regional cooperatives and consortia have enhanced the effectiveness of libraries. With the information superhighway near at hand even greater sharing and better access are real possibilities.

I would like to share with you some of our experiences at NAL that I believe can be models for the federal library community.

Enhanced Information Center

The first thing I want to share with you is the concept of the enhanced information center. This is more of an approach than a role, but it represents a key to becoming more involved in the changing world of libraries and information services.

While this concept relates more to human networks than to telecommunications networks, it is an idea that can be used very effectively to enhance the image and the effectiveness of federal libraries. It is in effect a very pro-active, non-traditional approach to providing information services. Information center staff at NAL work hard to stay abreast of the issues facing the agricultural community and to formulate materials on critical issues even before the questions can be asked. To quote NAL director Joe Howard, "...once we identify an issue, we begin amassing literature about it. Then we are ready when the world comes looking."

As an example, we are currently developing an information packet on global climate change, a key presidential initiative, even though little or no money has yet been made available in USDA to support the effort.

Another important activity for the pro-active information center is Out-Reach. The focus is to identify the audiences of key researchers and professional groups concerned about an issue or a topic and to establish a working relationship with them. NAL's Aquaculture Information Center Staff have been particularly successful in this area. Debbie Hanfman, IC Coordinator, is an active participant in that National Aquaculture Network.

Through this participation she is able to keep her fingers on the pulse of the profession and to more quickly adapt to their changing information needs.

Identification of Departmental Information Resources

A second approach to enhancing the role of federal libraries is to become a focus for departmental databases. One of the resolutions being put forward to the White House Conference on Libraries and Information Services by the Network Advisory Committee relates to strengthening public access to federal and state government information through networking. While much of this can be done through the existing depository library program, there are many more information resources within the government that are not identified in any meaningful way, let alone made available. This also fits in with FLICC's own resolution relating to the creation of a comprehensive locator system for federal information. Federal libraries can become the focal point for identifying such resources and for coordinations access to them through both local and national networks.

NAL is taking on a similar role for USDA in the areas of global change and plant genome research. A FY '91 initiative related to plant genome research activities gives NAL a vital role in the planning, creation, maintenance and dissemination of databases containing plant and animal genome data. NAL staff will assess the genome related data needs of USDA researchers, compare these needs with information available through existing databases and recommend appropriate new databases and networking structures to provide necessary access. Close collaboration and coordination will be necessary between NAL staff and the research community. As you might suspect, new non-librarian skills are necessary in both the database management and technical research subject areas in order to fulfill this expanded role. We are in the process of hiring staff with these skills, which compliment very nicely the information management skills of professional librarians.

A FY '93 program initiative includes the creation of a data management coordination center to provide improved access to global change data generated by USDA research programs. The center's activities would include identification of resources, description of resources, and access coordination to resources. It is amazing how little concern there is among research scientists with the organization and dissemination of data resulting from their own research. It is very appropriate for the librarians who are trained in the collection, organization and management of information to bring those skills to the masses of electronic information which are being developed as part of government research activities.

Becoming Experts on Access

A third area in which I see a role for federal libraries is in the area of enhanced access. We are, in fact, experts in finding information whether it be in paper format via a card catalog or an outline catalog or electronic format via CD-ROM or an online search service. It is a very small step to become the departmental or agency experts in finding information on the national network. Dozens of research libraries are making their computer catalog over the Internet. More and more databases are being made available. But the locator tools and the access mechanisms are brief, basic, and sometimes difficult to use. This is basically a world designed by techies for techies. However, as more and more information resources are made available and more users demand access, the need is there for librarians with information management skills who can:

- develop comprehensive directories
- prepare understandable documentation
- suggest an appropriate database on search strategies
- provide training and direction for users in this new electronic world

You can become the expert and help your patrons gain access to resources that few of them can imagine.

Focus Group

The final idea I want to mention is that of the federal libraries as a focus group for change. Federal libraries and information centers form a critical mass for identifying issues and problems that confront the information community regarding effective use of the national network. While the basic telecommunications structure and supporting protocols are in place, many issues relating to availability, ease of access, standard search protocols, display formats and many others remain to be resolved as we move

toward a more effective use of the network.

Federal libraries with their rich experience are a natural group to help identify and resolve these issues and problems. Effective use of networks will result in better information access, better resource sharing, and hopefully more effective use of both present and future information resources.

Balancing the E and R in the NREN: The Educational Imperative

Richard M. Dougherty
President, American Library Association and
Professor
School of Information and Library Studies,
University of Michigan

By the year 2000, every child will start school ready to learn. By the year 2000, U.S. students will be the first in the world in science and mathematics achievement. By the year 2000, every adult American will be literate and will possess the knowledge and necessary skills to compete in a global economy and exercise the rights and responsibilities of citizenship.

These are just three of the six ambitious goals President Bush and the nation's governors have set for American education. The subject of this forum, the proposed National Research and Education Network, must be a key piece of the infrastructure if the educational system has any chance to achieve these goals. Too few officials realize or appreciate that libraries--in communities, in schools, and education and research infrastructure. Even librarians don't yet fully appreciate the role libraries could play in making the "E" in NREN become a reality.

1. The NREN has the potential to revolutionize the conduct of research, education, and information transfer. At the same time literacy is becoming more of a problem in the United States, the skills needed to be truly literate are growing more sophisticated. Tomorrow literacy will have a new meaning. ALA calls this higher set of skills "Information literacy"--knowing how to learn, knowing how to find and use information, knowing how knowledge is organized. Libraries play a role in developing these skills, beginning with encouraging preschool children to read.

Libraries as community institutions and as part of educational institutions introduce users to technology. Many a preschooler and her grandparents have used a personal computer for the first time at a public library. Libraries are using technology, not only to organize their in-house collections, but to share knowledge of those collections with users of other libraries, and to provide users with access to other library resources, distant databases, and actual documents. Libraries have begun a historic shift from providing access primarily to the books on the shelves of local libraries to providing access to the needed information wherever it may be located. The NREN is the vehicle librarians need to accelerate this trend.

In Michigan, a pilot program called M-Link is making librarians at a group of community libraries into full main stream information providers. Since 1988, M-Link has enable libraries in Alpena, Bay County, Hancock, Battle Creek, Farmington, Grand Rapids and Lapeer to gain access to the extensive resources of the University of Michigan Library via the state's MERIT network. The varied requests of dentists, bankers, city managers, small business people, community arts organizations and a range of other users, are transmitted to the university's librarians via telephone, fax or computers and modems. Information can be quickly faxed back to the local libraries from the University. Access to a fully developed NREN would increase by several magnitudes both the amount and types of information available and the efficiency of such library interconnections. Eventually the NREN could stimulate the type of network that would be available to all these people directly.

School libraries also need electronic access to distant resources for student and teachers. In Information Age, schools linked to a fully developed NREN, teachers would work consistently with librarians, media resource people and instructional designers to provide interactive student learning projects. Use of multiple sources of information helps students develop the critical thinking skills needed by employers to function in a democratic society. This vision of an information age school builds on today's groundwork. For instance, the New York State Library is providing dial-up access for school systems to link the resources of the state library (a major research resource) and more than 50 public reference and research library systems across the state.

2. Current Internet users want library-like services, and libraries have responded with everything from online catalogs to electronic journals. As universities and colleges became connected to the Internet, their campus libraries' online catalogs were among the first information resources faculty and students demanded to have available over the network. Over 200 library online catalogs are already accessible through the Internet. The count keeps growing. Academic library users will increasingly demand full text databases and multimedia and personalized information resources in an environment in which the meter is not ticking by the minute logged, the citation downloaded, or the statistic retrieved. A telecommunications vehicle such as the NREN can help equalize the availability of research resources for scholars in all types, sizes and locations of higher educations institutions.

Libraries will be asked to make information resources available over the network, and the expertise of librarians will be needed to undertake the daunting task of organizing the exploding volume of electronic information. The Colorado Alliance of Research Libraries, a consortium of multitype libraries, not only lists what books are available in member libraries, but its CARL/Uncover database includes tables of contents from thousands of journals in these libraries. Libraries are also pioneering in the development of electronic journals. Of the ten scholarly electronic journals that are now in operation or in the planning stages, several are sponsored by university libraries or library organizations.

3. Libraries provide access points for users without an institutional basis. Many industrial and independent researchers do not have an institutional connection to the Internet. All such researchers and scholars are legitimate users of at least one public library. The NREN legislation as introduced does not reflect current use of the networks, much less the full potential for support of research and education. As a result, many libraries outside academe without access to academic networks have developed creative, if sometimes awkward, ways to fill the gap. A number of high schools have guest accounts at universities; only a few have managed to get direct connections. CARL, the Colorado Alliance of Research Libraries, reaches library users regardless of the type of library they are using or their point of access. The development of community computer systems such as the Cleveland Free-net is another example of providing network access to a larger community of library users. Several Cleveland area public, academic and special libraries are information providers on the Free-net as well.

Most of the California high technology companies, still have fewer than 50 employees. For these companies, there is no major research facility or corporate library. The local public libraries provide strong support as research resources for such companies. The California State Library encourages and supports such development, for example, through grants to projects like the Silicon Valley Information Center in the San Jose Public Library. Library access to the NREN would markedly improve libraries' ability to serve the needs of small business.

Support of research and education needs in rural areas could also be aided through library access to the NREN. Even without such access, libraries are moving to provide information electronically throughout their states, often through state networks. An example is the North Carolina Information Network. NCIN, through and agreement between the State Library and the University of North Carolina's Educational Computing Service, provides access to information to almost 400 libraries in every part of the state from university and corporate libraries in the Research Triangle Park to rural mountain and coastal public libraries, to military base libraries. Using federal Library Services and Construction Act funds, the State Library

provides the local equipment needed at the packet nodes to permit access to the system (called LINCNET) to these local libraries.

The information needs of rural people and communities are just as sophisticated and important as the needs of the people in urban areas. Because the North Carolina network is available in rural libraries, small businesses in these communities have access for the first time to a state database of all contracts for goods, services, and construction being put out for bid by the state-just one example of network contribution to economic development. The key to the network's growing success is the installation of basic computer and telecommunications hardware in the libraries, access to higher speed data telecommunications, and the databases searching skills of the librarians.

4. With libraries and their networks, the support structure to make good use of the NREN already exists. Librarians have been involved in using computers and telecommunications to solve information problems since the 1960's when the library community automated variable-length and complex records—a task which was not being done by the computer field at the time. Libraries pioneered in the development of standards, so that thousands of libraries could all use the same bibliographic databases, unlike the frustrating E-mail systems today which each require a different mode of address. The library profession has a strong public service orientation and a cooperative spirit; its codes of behavior fit well with that of the academic research community.

Libraries have organized networks to share resources, pool purchasing power, and make the most efficient use of telecommunications capacity and technical expertise. Upgrading of technological equipment and technological retraining are recognized library requirements, although the resources to follow through are often inadequate. The retraining extends to library users as well. Librarians are familiar with the phenomenon of the home computer or VCR purchaser who can word process or play a tape but is all thumbs when it comes to higher functions not used every day. Computer systems, networks, and databases can seem formidable to the novice and are often not user-friendly. Expert help at the library is essential for many users.

5. NREN development should build on existing federal investments in the sharing of library and information resources and the dissemination of government information. The Internet/NREN networks are in some cases not technically compatible with current library networking arrangements. However, the government or university database or individual expert most appropriate to an inquiry may well be available only via the Internet/NREN. Access to specific information resources and the potential linkage to scarce human resources is one reason, and the librarians are likely to need at least some access to the NREN. No library, no matter how large, can afford all of the information experts it might desire or even need. At my own university, for example, the subject of our reference staff and the breadth of our collection is great, but we don't possess expertise or the specialized materials on the development of copper mining that can be found in a small public library in the Keweenaw Peninsula.

As the Internet/NREN is used by various federal agencies, it becomes a logical vehicle for the dissemination of federal government databases. The Government Printing Office, through its Depository Library Program, has begun providing access to government information in electronic formats, including online databases. A unified government information infrastructure accessible through depository libraries would enable all sectors of society to use effectively the extensive data that is collected and disseminated by the federal government. Disseminating of time- sensitive documents electronically would allow all citizens, small businesses and nonprofit groups to have real-time access to government information through an existing organized system of depository libraries.

A natural test bed of selected libraries already exists. The 51 regional libraries, generally one in each state, many of which are libraries already connected to the Internet, could provide the original nodes for such a system. Together with major libraries capable of providing such support, these libraries could provide access for smaller libraries and selective depositories within their states or regions through dial-up facilities or local area networks.

The library community has been assisted and encouraged in its networking efforts by the federal government beginning in the 1960s, and more recently by state support as well, in ways that track

well with the NREN model. The federal government already spends in the neighborhood of $200 million per year on programs which promote and support interlibrary cooperation and resource sharing and library applications of new technology. These programs range from the Library Services and Construction Act, the Higher Education Act Title II, the Depository Library Program, the library postal rate structure, and the Medical Library Assistance Act, to programs of the three national libraries--the Library of Congress, the National Agricultural Library, and the National Library of Medicine.

If academic libraries continue their migration to the Internet/NREN as the network of choice both on campus and for communication with other academic institutions, it will not be long before academic libraries and public libraries find themselves unable to talk to one another electronically. This result will be totally at odds with the goals of every major legislative vehicle through which the federal government assists libraries. In libraryland we will be in danger of building electronic railways of different gauges. It makes no sense, given the intimate connection of public libraries to the support structure for research and education. While public libraries have long been recognized as engines of lifelong learning, the connection is much more direct in many cases, ranging from the magnificent research resources of a New York Public Library to the strong support for distance learning provided by many public libraries in western states.

Interlibrary loan and reference referral patterns also show that every kind of library supports every each other's mission. The academic, public, school, state, national, and specialized libraries of the nation constitute a loose but highly interconnected system. A network which supports research and education, or even research alone, cannot accomplish the job without including this multi-type system of libraries in planning, policy formulation and implementation.

6. The NREN's higher speeds will enable the sharing of full text and nontextual library and archival resources. Libraries will increasingly need the higher capacity of the NREN to exploit fully library special collections and archives. The high data rates available over the fully developed NREN will make possible the transmission of images of journal articles, patents, sound and video clips, photos, artwork, manuscripts, large files from satellite data collection archives, engineering and architectural design, and medical image databases. Work has already begun at the national libraries, including the Library of Congress American Memory project and the National Agricultural Library's text digitizing project.

7. Libraries provide a useful laboratory for exploration of what services and what user interfaces might stimulate a mass marketplace. One purpose of the NREN bills since the beginning has been to promote eventual privatization of the network. Libraries have already demonstrated the feasibility and marketability of databases in the CD-ROM format. Libraries also convinced proprietors and distributors to accommodate the mounting on local campus systems of heavily used databases. Libraries can serve as network use test beds in their role as intermediaries between the public and its information requirements.

8. Public, school and college libraries are appropriate institutions to bridge the growing gap between the information poor and the information rich. While we pursue information literacy for all the population, we can make realistic progress through appropriate institutions set up to serve the public such as libraries. However, while an increase in commercial services would be welcome, we believe that any transition to privatization should not come at the expense of low-cost communications for education and libraries. Ongoing efforts such as federal library and education legislation, preferential postal rates for educational and library use, and federal and state supported library and education network provide ample precedent for continued Congressional attention to open and inexpensive access. Some officials already can visualize how an NREN enriched environment might impact society.

Sen. Albert Gore, Jr., speaks eloquently of the school child going home and tapping into the riches of the Library of Congress for a homework assignment.

Dr. D. Allan Bromley, the President's science advisor and director of the Office of Science and Technology Policy, imagines how libraries will change when most American homes are connected to them over local networks via a wide-bandwidth channel.

Rep. Don Ritter (R-PA), at hearings last year, recognizing the potential importance of the NREN,

expressed sentiments that we believe reflect those of many in Congress, when he wondered if the network was to be an eight-lane highway just for the Rolls Royces, or if it would also serve the pickup trucks and Chevys.

The clear intent is that sooner or later the benefits of this wonderful network would reach every school and library and ultimately every home. The trouble is that the bill, in the form that passed the Senate last year and has now been reintroduced, does not embody this vision. It is, in fact, much more narrowly focused.

What's missing from the current bills? Several elements are needed to ensure that the NREN meets the needs of the broader research, education and library communities.

Let me cite specifics that we believe require clarification:

a. Recognition of education in its broadest sense as a reason for development of the NREN;
b. Eligibility of all types of libraries to link to the NREN as resource providers and as access points for users; and
c. A voice for involved constituencies, including libraries, in development of network policy and technical standards.

At the recent Congressional hearings, members of the science committees asked witnesses who should run the network. The clear consensus was the National Science Foundation. Of the existing federal science agencies, it is the best choice, not only because the NREN builds on the NSFNET, but because NSF is responsive to the broadest constituency and supports the widest variety of science and technology research and applications.

However, in a network designed to support research and education, policy should not be determined solely by a group of federal agencies. The research, education and library communities should have an important voice in policy formulation.

The legislation should also ensure that the NREN is developed with:

a. High capacity network connections with all 50 states;
b. A percentage of network development funds allocated for education and training; and
c. Direct connections to the NREN for at least 200 key libraries and library organizations and dial-up access for multi-type libraries within each state to those key libraries.

Prime candidates (some of which are already connected to the Internet) for direct connection to the NREN include:

- The three national libraries (Library of Congress, National Agricultural Library, National Library of Medicine) and other federal agency libraries and information centers;
- 51 regional depository libraries (generally one per state) which have a responsibility to provide free public access to all publication (including those in electronic formats) of U.S. government agencies;
- 51 state library agencies (or their designated resource libraries or library networks) which have responsibility for statewide library development and which administer federal funds; and
- Libraries in geographic areas which have a scarcity of NREN connections;
- Library networks and bibliographic utilities which act on behalf of libraries.

With a voice for the education and library communities in network policy, with a 50 state network backbone, and with direct connections for some 200 key libraries, the framework would be in place for other developments.

Think of the Library of Congress American Memory project available over the NREN; think of all three national libraries as libraries of last resort, not just for interlibrary loan, but for electronic transmission of full text, maps, photos, manuscripts, video clips, and so on.

Think of GPO's Depository Library Program using the NREN as a vehicle for access to government databases.

Think of using the Library Services and Construction Act and Higher Education Act library program funds to stimulate additional library linkages to the NREN, and to develop bibliographic, full text, and nontextual databases.

Such efforts would give new meaning to the sharing of library resources, and could be extended to the development of network and database directories, continuing technological education for librarians, and training packages for end users.

The environment I envision is one that insures synergistic relationships between the research and education sector of our society. It is one that will

have achieved a balance between these two distinctive but overlapping sectors which I believe will be essential in a network society. If successful we may look back a generation from now and realize that the creation of a nation-wide network accessible to all was the bridge that took us firmly and finally into the Post Industrial world.

Supporting the Modern Researcher

Chancellor Donald N. Langenberg
The University of Maryland

By this time, you have received a very clear message: modern information technology has presented us with a challenge of unprecedented scale. Let me summarize it in a way that seems appropriate to this occasion.

The Library of Congress contains about 20 terabytes of information. It took over two centuries to collect. It's stored in this very impressive building, which I think we would all agree is an expensive piece of real estate. Now consider these additional facts. Today's medical imaging machines produce that Superconducting Super Collider will one day engulf their already has 1.2 million magnetic tapes containing data from past Congress every year. In ten years if all goes according to plan, NASA will be piling up about fifty Libraries of Congress each year. Everywhere one looks, similar gushers of information exist or are in prospect. To paraphrase Daniel Boorstin, a former Librarian of Congress, the flood of information can drive out knowledge. Something needs to be done to make this ocean of information available and useful to scholars and researchers.

Communication is the essence of research. The researcher's life has always been strongly dependent on the current state of technology because it is technology that limits or enhances the researcher's ability to communicate with other researchers.

Our discovery of how to transmit information electromagnetically has reduced major constraints on researcher's abilities to manage their fundamental working material—information. An important feature of this electronic revolution is the digital computer.

In recent years a remarkable marriage has occurred, the merger of computer and telecommunication technologies to form what is now called "information technology." The combination of the computer's ability to store and manipulate information with telecommunication's ability to move information rapidly from place to place is yielding and unprecedented capability for handling information. Information technology will place in the hands of a researcher a new tool for performing every research function save one--thinking!

In the foreseeable future, a researcher might have a workstation linked with others and with millions of information sources worldwide through a high performance computing network like the one we heard about this morning.

This system would be sufficiently "user friendly" to be usable by any researcher, yet capable of meeting the needs of the most demanding. It would enable a typical researcher to communicate across space and time in ways that are only now being thought possible. But to reach this idea point, we have a long way to go.

Several years ago, I chaired the Panel on Information Technology and the Conduct of Research, which issued a report entitled *Information Technology and the Conduct of Research: The User's View*. The report makes clear that, although technical and financial constraints are having important effects on our ability to realize the full potential of information technology for researchers, behavioral and institutional constraints may be even more important.

The latter factors have thus far been given much less attention than the former. I believe we must turn our attention to them, for I am convinced that the inevitable growth in the use of information technology by researchers will be accompanied by equally inevitable pervasive changes in the infrastructure of research. In short, we must rethink how we can best support the researcher in the age of information.

To see what we ought to be rethinking, let us briefly review how we now support our researchers. Most researchers belong to institutions which are universities, or national laboratories, or for the current purpose of simplification, I will call all organizations which support researchers "universities."

Universities pay researchers, provide them with working space and provide various support services, many of which enhance communication. Among these support services are libraries, computers, mail services, and telephone systems.

The word "library" can mean a building, a room, or a collection of publications. It can mean a place where one finds librarians, people who provide professional assistance to researcher seeking information. For present purposes, it seems useful to think of a library as a provider of all those things.

A computer center has the same general characteristics as a library. It is increasingly, however, only a part of an electronically linked family of computers, a "network," to use the current term. Network may involve a single office or department, or they may cover the university, the nation, or the globe. Networks may or may not incorporate a computer "center," in the sense of including a mainframe or supercomputer.

Telephone systems and mail services share some of the characteristics of libraries and computers.

Together, these four types of organizations or systems form a support infrastructure for researchers which has the following functions:

1) It stores information in forms that make it accessible to researchers.
2) It provides a means by which researchers can communicate with one another over space.
3) It helps researchers manipulate information, assisting them to create new information, new insights, and new knowledge.
4) It provides both human and non-human assistance to researcher using it, being as user-friendly as possible.

Wherever new developments in information technology may lead us, the systems through which we support researchers must continue to have these basic functions. However, they need not necessarily resemble any of the organizations, institutions, or systems we currently use for this purpose. To free ourselves of preconceptions as we think of how to adapt our current institutional arrangements for the support of researchers in the Information Age, it seems appropriate to adopt a new working name for what we must develop. I propose the term "infory." The word is short, simple, and derives from the term "library," Our word for information infrastructure based on a particular physical artifact, the book, or "libra." The infory is similarly but more generally based on information, in whatever form it might be embodied.

"Infory" might refer to a physical place, a collection of information, artifacts, or the workplace of a group of professional information technologists. It is not intended to suggest a computerized library. The fundamental functions of an infory would include:

1) providing researchers with open and convenient access to information and communication resources of all kinds;
2) nurturing a community of professional information technologists dedicated to maintaining and improving infory services to researchers; and
3) supporting and maintaining a competitive market in ideas and products related to the generation and use of information.

Let me expand a bit on each of these functions.

The first, the provision of service in support of research is the primary infory function. Some information resource might be housed by the infory itself. Much information will be based elsewhere and accessed electronically via networks. This includes the capability by which researchers can send to and receive from other researchers communications ranging from simple personal messages to the high speed transmission of huge amounts of data.

The second function, that of nurturing a profession of information technologists, requires a stable professional structure, opportunities to build a career that confers identity and status accompanied by respect, and opportunities to conduct research in the information technology profession. Models for this professional structure might be the scientific

staffs of some national laboratories or the professional librarians of our great libraries, who both maintain their own research programs and contribute to their professional fields.

Won't the needed innovations come from other researchers and from the information technology industry? Can't we fill our needs with competent drones to support our researchers? I see no evidence in the present situation to support such an expectation. Requirements for sophisticated software which can control the acquisition and management of data in a special research environment are unlikely to come from commercial software vendors. It is not good use of a researcher's time and talents to expect him/her to sit down and grind out the necessary software. The result is likely to be inelegant, inefficient, expensive, and it will rarely contain the necessary documentation to make it usable by others. The next researcher, having the same programming needs, will have to reinvent the wheel.

There is clearly a need for creative, innovative people to dedicate their careers to serving researchers' needs for information resources, especially specialized software. An infory could provide the attractive professional environment in which such people could work.

It follows then that the third important function is the dissemination of software useful to researchers. An infory, therefore, ought to contribute to a national and international capability for developing and imposing standards and for evaluating and certifying software for researchers. The analogs are to be found in the peer review systems used by the scholarly community, particularly universities, in appointing faculty and granting tenure, and by federal agencies and foundations in reaching decisions on proposals. Similar systems are used by journal editors and book publishers in deciding what to publish and what to reject. No comparable system of judging software now exists. The management of such a system might well be done by the staff of some infory.

Whence would infories come? They will probably evolve gradually from existing institutions: from libraries, from data repositories, from commercial information enterprises. As long as we can avoid the trap of thinking only in traditional terms founded on traditional assumptions, terminology won't matter.

What kinds of organizations might host an infory? Any kind which has as part of its mission supporting the information needs of researchers of which itself employs researchers must provide some of the services. Infories might take on a variety of forms and have a variety of hosts. Each, however, would function as a node in a broadly interconnected network of information resources designed to support the global researcher.

How are we going to pay for infories? We will need to seek new funds in many cases, but, for the most part, we will probably begin by using resources already committed to existing information support systems. We are already investing substantial portions of our available revenues for this purpose. As our present libraries, computer centers, telecommunications, and mail services evolve toward infories, we can expect an accompanying evolution in funding.

The explosive development of information technology portends change, perhaps radical change, in many aspects of the lives of almost everyone. Few groups will be more profoundly affected than the world's researchers. Exploited to the full extend of its potential, information technology can literally give every researcher a global reach, almost instantaneously placing him or her beside any desired collaborator anywhere, or in direct contact with any storehouse of knowledge. Before this can become reality, a great deal of technology must be developed, both hard and soft. Funds must be found and allocated to develop the technology and to place it in the hands of researchers. But perhaps the most difficult challenge of all will be to learn how to transform the institutional infrastructures we have developed over centuries into organizational arrangements for the support of research which are compatible with the new technology.

Future Implications for the Profit and Not-For-Profit Sectors

Allan H. Weis
President and CEO
Advanced Network & Services, Inc.

Good afternoon. It's a pleasure to be here to discuss a subject which will profoundly affect our lives—indeed the lives of every American—in ways which we can now barely imagine.

I want to cover two topics:

The Potential of a Nationwide High Performance Network, and The Future Implications for the Profit and Not-For-Profit Sectors.

First, the potential-

As I am sure all of you know, the President's High Performance Computing and Communication initiative and both the Senate and House versions of the High Performance Computing Act envision a national multi-gigabit-per second research and education computer network by 1996.

The national research and education network—more commonly known as NREN—initially will link scientists, researchers, educators and librarians in government, industry and academia across the country. Over time, organizations af all types, from the smallest elementary school through the largest corporation, will be linked together.

Transmitting several billion bits of data per second, as NREN envisages, will offer network users unprecedented opportunities to extend the frontiers of technology and science. Composite imaging and interactive visualization are emerging important, but the human mind is capable of quickly visualizing the importance and relevance of data displayed as images. And the masses of data will be very big indeed.

Every five days, the volume of data from the planned earth observation system will equal the total information now in the Library of Congress. Absent a very high speed network, researchers throughout the country simply can not work with data of this magnitude. For the network to truly be successful, it must include libraries. As Carol Henderson so aptly put it in FLICC Special Report 90-6, "The Library and information center community possesses a ser of skills in organization of information... that is unparalleled and that is needed in the development of electronic resources on the NREN." Ron Larsen was equally cogent in his speech, saying:

"A large-scale high-performance computer network serving only supercomputer users would likely never become a viable economic entity. The community of users is simply too small and the bottom line is that if networks have to depend on supercomputer users for their support, high performance computer networks on a national scale will be largely unaffordable."

With this potential as a tool for the research and education community-how is the National Network landscape evolving and how will the evolution effect the for profit and not-for-profit sectors. What will be the future implications?

Network service providers such as ANS have changed the way many institutions can attach and use the national network. They are also changing the speeds and thus the basic applications that can use the network.

Let me be specific and describe how the privatization of some of the regionals and the backbone by

the new network service providers are fostering three changes and then describe what the implications will be for both the profit and not-for-profit sectors. Many other changes are also occurring- but let's focus on these three.

1) The funding paradigm for the network infrastructure is beginning to change. The new network service providers are investing in their own or shared infrastructures, and as these infrastructures are put in place, network usage grows and unit costs decline. Thus, emerging network providers will become less dependent on government support and gradually will become self sustaining from operating revenues. And, as network providers become self sustaining, government support increasingly can be targeted for special programs needed to achieve the goals of the NREN.

2) The emergence of many new services will create a larger NREN and foster growth in all sectors. In the for profit sector, many companies have been reluctant to use the network for security reasons. But now, secure gateways allow the industrial research community to connect where it previously may not have done so for that concern was expressed by a large pharmaceutical company with which I recently spoke. The company wanted to connect to the network in order to obtain significant productivity savings, thereby gaining a competitive edge. Using the applications and information on network would allow them to cut their design cycles and build better drugs faster. The film looks for unique DNA structures. The information they search against is too expensive to maintain locally, and it is absolutely critical that the data be current.

But until the company had secure gateways and a framework that permitted it to use the network in a production—not experimental— mode, the risk of connecting outweighed the reward. With over 2,000 new structures added each month to that national data base, the information would never be available on paper. By offering new services such as secure gateways, the new network service providers are opening new opportunities for the profit sector to help fund and reap the rewards of the network. By fostering the growth of new users- individual researchers, information providers and high end state-of-the-art applications such as visualization- the network will grow more rapidly and be a more valuable tool for all classes of users.

3) The third implication of the changes that will effect both sectors and make the national network a more valuable tool for all users are the rules that govern its acceptable use. These Acceptable Use Policies (AUP's) have implications on who connects and what use can be made of the network by the institution once its connected.

Federal or State funding of segments of the network have restricted, by varying degrees, the use of the network by various users and applications. For example, a doctor at Yale can use Medline for his research and classwork but not for his private practice. There are hundreds of other examples, but the point is that we are in the middle of an evolution.

As the network service providers become self sufficient and no longer receive government subsidies those providers can handle all varieties of users and uses.

The payoff of these changes for typical organizations will be a sharp improvement in the productivity of their "information workers". As their productivity soars with quick and efficient access to just the right information resources—including the information resources available within their own organization and from their suppliers and customers—better and quicker decisions will be made. This will be somewhat like "just in time" systems in manufacturing but it will apply across the board, including the public sector.

Quick and efficient access to the right information resources will produce leaner and meaner organizations which will better understand and then satisfy the needs of their customers, constituents, and clients. This will make them efficient and competitive. Information management will be a major key to improve gross national product in America. It will materially increase the real income of every American.

Finally, better information management also must involve the improvements made possible by electronic storage. While paper will remain immensely popular because of its portability and ease of reading, information storage—which permits rapid search and retrieval—will increasingly involve less paper more electronic storage.

The key challenges that lie in the path to achieving the NREN are not all technical. They include

social, organizational, political and financial issues. Organizations like yours will help to pave smoother super highways by organizing the explosively growing information resources in this country and throughout the world. More data is not enough—your skills are needed to make it accessible on a practical and economic basis.

Along with thousands of typical Americans, I'm looking forward to the improvement in information management and distribution which will be a part of NREN. The librarians of this country will play a very, very important role in helping both profit and nonprofit organizations become more efficient. I'm also looking forward to the improvements in education from kindergarten through graduate school which NREN, properly implemented, will bring. For all these organizations can only be as good as the people who come to work with them.